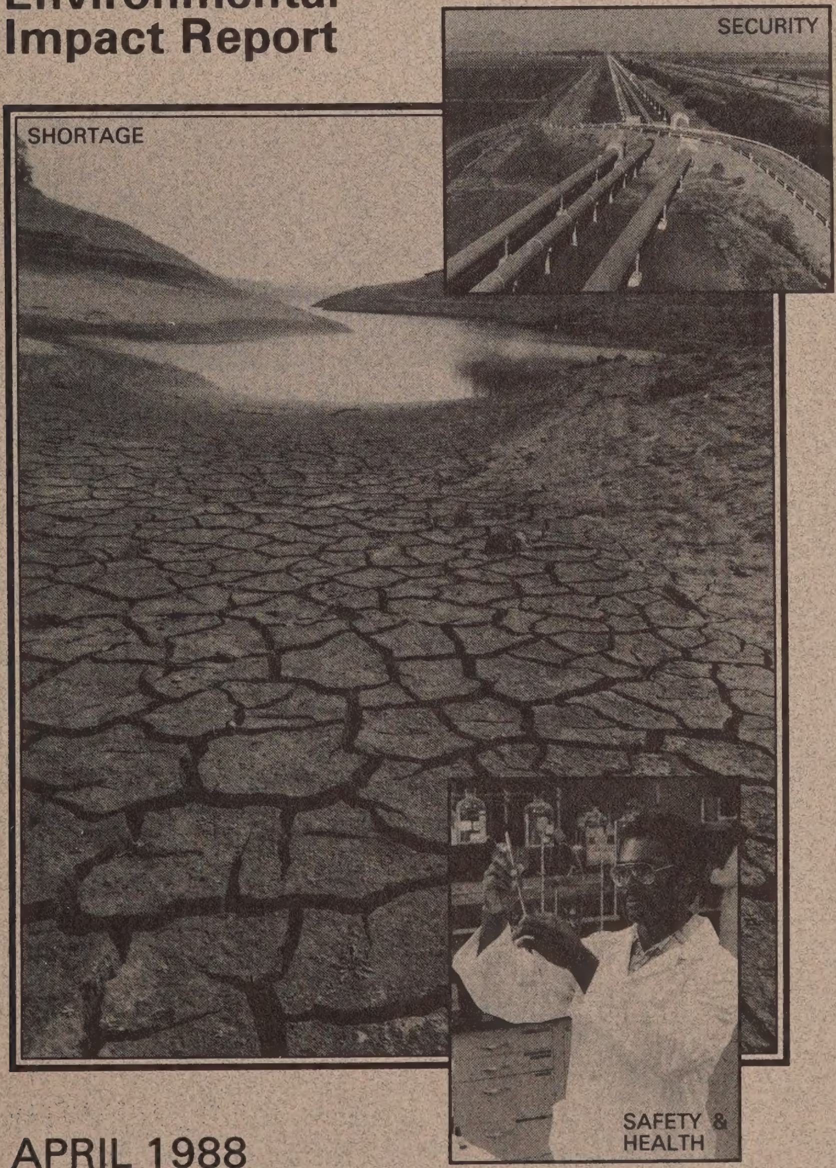
WATER SUPPLY MANAGEMENT PROGRAM

Draft Environmental Impact Report



APRIL 1988

East Bay Municipal Utility District

EBMUD

WATER SUPPLY MANAGEMENT PROGRAM

DRAFT

ENVIRONMENTAL IMPACT REPORT

Prepared for

EAST BAY MUNICIPAL UTILITY DISTRICT

Prepared by

EIP ASSOCIATES

April, 1988

EBMUD WATER SUPPLY MANAGEMENT PROGRAM

DRAFT EIR OUTLINE

DRAFT EIR OUTLINE continued

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1 INTRODUCTION

1.1 PURPOSE OF THE ENVIRONMENTAL IMPACT REPORT

The East Bay Municipal Utility District (EBMUD or henceforward, the District) plans to adopt a Water Supply Management Program (WSMP) which may include a number of improvements to its water supply system. The improvements are designed to increase the security of the water supply system during natural disasters, to meet dry year water demands in the future and to maintain the quality of supplied water. The actions are described in detail in the District's Technical Report on the WSMP.[1]

Before making a decision on the WSMP, the District must fulfill the requirements of the California Environmental Quality Act (CEQA). CEQA requires that the environmental consequences of a proposed action be examined and described in an environmental impact report (EIR).

1.2 THE ENVIRONMENTAL REVIEW PROCESS

CEQA requires that an EIR be prepared that fully describes the environmental effects of a proposed project or program before a decision is made to proceed. This EIR is written to fulfill the requirements of CEQA. It is a public document that will be used to examine the environmental effects of the proposed program and various alternatives, and to explore ways to lessen or avoid adverse environmental impacts by adoption of recommended mitigation measures.

The District will act as the lead agency for the EIR because it is the program proponent. The lead agency is responsible for preparing the environmental document and ensuring that it meets legal requirements.

The first step in the CEQA process is the issuance of a Notice of Preparation informing interested parties that an agency intends to prepare an EIR. The District issued the Notice of Preparation for this EIR in February, 1987. A scoping meeting was held on March 17, 1987 with concerned government agencies and interested individuals to determine what issues should be addressed in the EIR.

This Draft EIR/EIS is now available for public review. A public meeting conducted by District staff will be held on May 18, 1988 followed by a public hearing conducted by the EBMUD Board of Directors on May 25, 1988. Written comments on the Draft EIR must be received by June 17, 1988. Responses to all comments will be prepared and included in the Final EIR. The District will then formally review the document and decide whether the Final EIR accurately portrays the environmental consequences of implementing the proposed program, thus fulfilling CEQA requirements.

1.3 ORGANIZATION OF THE EIR

The District's proposed WSMP can affect a broad geographical area and numerous aspects of the environment. A comprehensive evaluation of the various elements of the program is necessarily lengthy. The EIR has been organized to be useful to both the technical reviewer who needs to consider various impacts in detail and the more general reader who wants to understand the main consequences of implementing the program but does not have time to read the entire document.

The chapter following this introduction is a summary of the environmental effects of the proposed program. The summary is designed to provide the general reader with the relevant information on which decision-making will be based. More detailed information is provided in the subsequent chapters.

Chapter 3 is a general description of the proposed WSMP and why it is needed. Alternatives to the WSMP that were considered but rejected by the District are described in Chapter 4. The plan consists of five principal elements. The five elements are described in Chapters 5 through 9. Each chapter is organized in sections: initially, a description of the environmental setting, followed by an assessment of the environmental effects of construction (if necessary) and operation, and lastly, suggested mitigation measures to reduce or eliminate potentially significant adverse short- and long-term

impacts. The relationship between the WSMP and urban growth in discussed in Chapter 10. Chapter 11 contains a discussion of several other topics necessary to fulfill CEQA requirements.

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[1] Water Supply Management Program, Technical Report, EBMUD, 1988.

2 SUMMARY

2.1 WATER SUPPLY MANAGEMENT PROGRAM

2.1.1 PROGRAM ELEMENTS

EBMUD currently supplies water to approximately 1.1 million people within a 310 square-mile service area. The service area includes 20 cities and 15 unincorporated communities within two counties. At present the average daily water demand met by the District's system is about 220 mgd. By 2020 it is estimated that the demand for water will increase to between 270 and 280 mgd.[1] EBMUD has developed a program to reduce the vulnerability of its system to natural disasters, to meet demand during droughts, and to maintain the quality of its supplied water. The proposed program, known as the Water Supply Management Program or WSMP, is shown in Table 2-1. The various elements of the program are discussed in this EIR under the five following headings:

- Additional Terminal Storage (Water Banking)
- Levee and Aqueduct Foundation Improvements in the Delta
- Water Conservation
- Water Reclamation
- Protection of Water Quality

Each element is described briefly in the following paragraphs.

Terminal Storage

The District has five terminal reservoirs in the East Bay hills which collectively provide 138 thousand acre-ft. of usable water storage.[2] The multiple have multiple purposes. They are used to regulate delivery of the supply from the Mokelumne Aqueducts by storing imported water and local runoff in the winter for use during summer peak demand periods. They also provide standby storage for use during droughts and in the event of a failure of the Mokelumne aqueduct system or other primary conveyance facility.

TABLE 2.1

PROPOSED WATER SUPPLY MANAGEMENT PROGRAM

Objective	Element	Action	Cost	Timing
Security: Protect Against Floods and Earthquakes	Water Banking (Additional Terminal Storage)	Construct New Terminal Reservoir 145,000 Acre-Feet	$152 to $186 Million	In Service in 1995
	Levee and Foundation Improvements in the Delta	Continue Repair, Maintenance, and Upgrading of Levees	$8 Million	Complete by 1991
		Preliminary Engineering of Levee Reinforcement and Pipeline Supports	$2 Million	Complete by 1995
Shortage: Supply to Meet Water Demands in Dry Periods	Water Banking (Additional Terminal Storage)	See Security	See Security	See Security
	Water Conservation	Implement Additional Measures and Continue Existing Program	$0.6 Million Per Year	Implement Immediately
	Water Reclamation	Develop New Reclamation Projects and Continue Existing Program	$15 Million	Implement Immediately
Safety and Health: Maintain High Quality Water	Enhance Watershed Lands of Terminal Reservoirs	Purchase Additional Watershed Lands to the Ridgelines	$20 Million	Complete by 1995
	Treatment Improvement Program	Continue Treatment Plant Modernization and Improvements	$35 Million	Complete by 1992

The District proposes to increase terminal storage by constructing a sixth reservoir at one of three selected sites. The alternative storage projects found most feasible are referred to as Pinole, Buckhorn and Los Vaqueros Reservoirs. Their locations are shown in Figure 2-1. Pinole Reservoir would have a usable capacity of 44 thousand acre-feet. Buckhorn would have a usable capacity ranging from 78 to 143 thousand acre-feet depending on the height of the dam selected. The environmental assessment work has been carried out assuming the larger size reservoir for the Buckhorn site. Los Vaqueros Reservoir would have a capacity of 50 to 1,065 thousand acre-feet and would be built in association with other water agencies and is not discussed in detail in this document. A separate environmental assessment of the Los Vaqueros project has been prepared by Contra Costa County Water District.[3]

Levee and Aqueduct Foundation Improvements in the Delta

Most of EBMUD's water supply is conveyed from the Mokelumne River to the Bay Area in several parallel pipelines referred to as the Mokelumne Aqueducts. Because the Mokelumne Aqueducts cross the Sacramento-San Joaquin Delta, they are vulnerable to failure during earthquakes and floods. EBMUD plans to reduce their vulnerability by making various structural improvements. Some field testing of possible improvements is necessary before proceeding with a large remedial program. The field tests include testing of pile foundation and levee studies. Collectively, the preliminary engineering field tests and design activities constitute an element of the WSMP.

Water Conservation

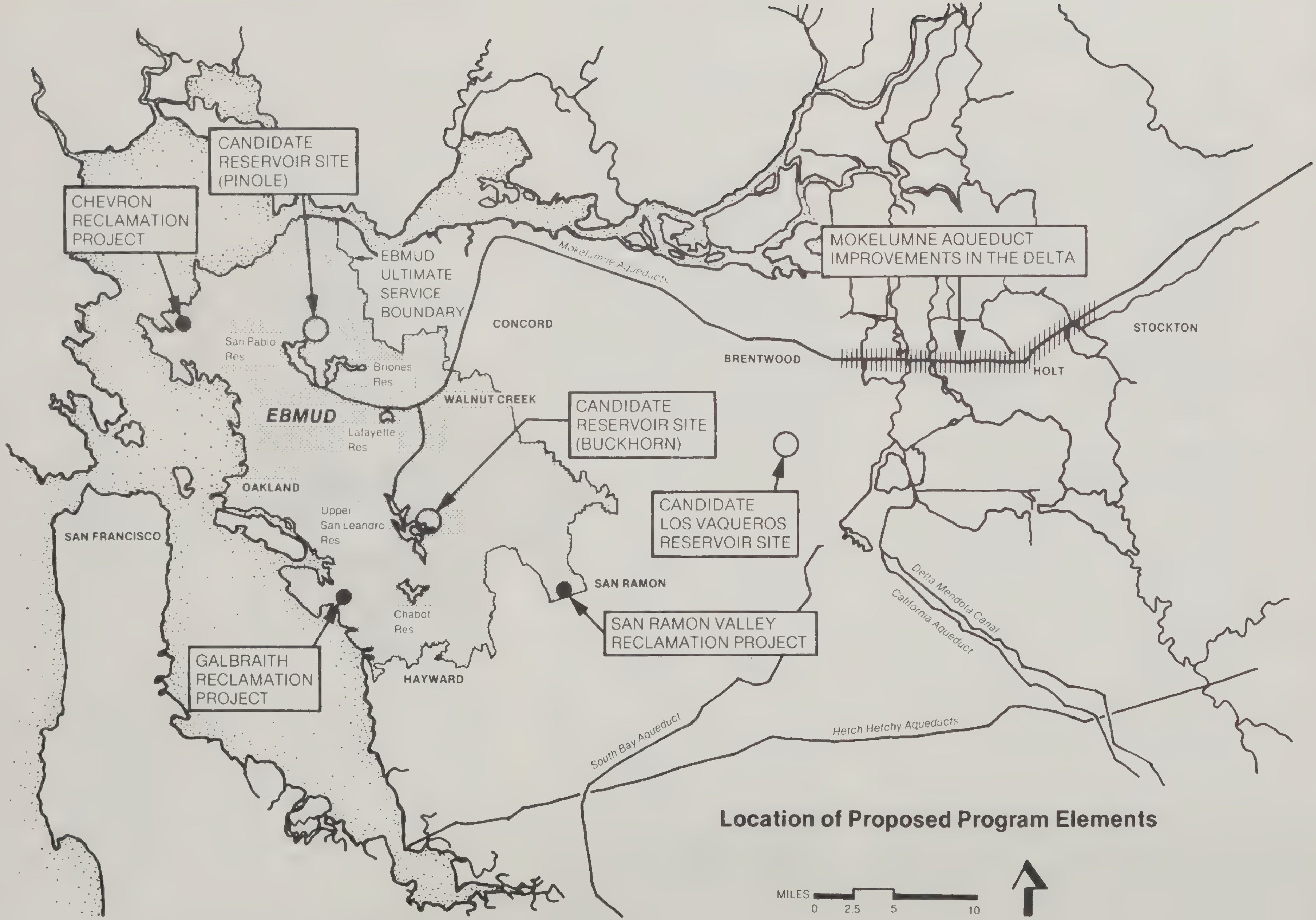
The District has been implementing a water conservation program for more than 15 years. One element of the WSMP is an expansion of the existing program described in the District's Urban Water Management Plan.[4] The proposed additional water conservation measures include greater distribution of water conservation devices that can be fitted into existing toilets and showers, free indoor water audits, promotion of water efficient landscaping, expanded public education, and further water conservation activities at District facilities.

Water Reclamation

This element of the program is a continuation of District activities designed to substitute reclaimed water for potable water when demand can be met by a lower quality water.

SITE LOCATION MAP

FIGURE 2-1



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Examples are irrigation of golf courses with reclaimed water (Richmond Golf Course) or use of reclaimed water for industrial purposes at Chevron's Richmond refinery.

Protection of Water Quality

This element of the WSMP is a continuation of the District's current water quality monitoring treatment improvement and watershed control activities. It includes numerous activities designed to maintain the quality of waters stored in the District's reservoirs. Examples are vegetation management, erosion control, recreation management, routine patrolling of watershed areas and testing of new treatment technology.

2.1.2 ENVIRONMENTAL REVIEW

Different elements of the WSMP require different levels of environmental review. The water quality protection, water conservation and reclamation elements involve new actions that are a continuation of existing programs. New water reclamation projects are typically subject to review under the provisions of the California Environmental Quality Act on a case-by-case basis. Preliminary engineering studies and design for Mokelumne aqueduct improvements are preparatory actions for facility projects that are not now defined in detail and may or may not be necessary based on assessment of risk potential. The above program elements are all subject to environmental review at the "program" level (CEQA Guidelines, Section 15168). Further environmental review will be necessary as several of these elements focus on specific construction projects. The remaining element of the proposed program, additional terminal reservoir storage, is analyzed in detail at the "project" level (CEQA Guidelines, Section 15161).

Three alternative terminal reservoir sites are under consideration -- a Buckhorn Canyon facility in the Upper San Leandro Reservoir watershed, a Pinole Valley facility several miles north of San Pablo Reservoir, and a Los Vaqueros facility on Kellogg Creek due west of the Clifton Court Forebay along Vasco Road. Potential impacts and mitigation measures have been assessed for the first two alternatives; Buckhorn and Pinole, the Los Vaqueros facility has been examined in a separate EIR which is summarized and incorporated by reference in this report. (Draft Stage 1 Los Vaqueros/Kellogg Project EIR, Contra Costa County Water District.)

2.2 POTENTIAL IMPACTS

The effects of WSMP elements on the environment are discussed in the following paragraphs.

2.2.1 LAND USE

<u>Additional Terminal Storage</u>

Construction of an additional terminal reservoir in the hills of the East Bay would result in the conversion of between 800 acres and 1,200 acres of undeveloped, District owned, watershed lands, primarily used for cattle grazing to an artificial body of water. Approximately 74 acres of additional private lands would be purchased, in the case of Buckhorn Reservoir, to construct the reservoir, and for pipeline right-of-way and a pump station site. In the case of the Pinole project, five acres of land would be acquired for tunnel and pipeline easement purposes.

Land use in the vicinity of the proposed project site (Buckhorn or Pinole) would remain the same as at present. Project development would not impact surrounding land uses.

Land use impacts of the Los Vaqueros Reservoir project are presented in Chapter 3 (p. 3-109 through 3-119) of the Draft Stage 1 Los Vaqueros/Kellogg Project EIR prepared for CCWD in May 1986. Project implementation would require the acquisition of approximately 12,000 acres with attendant impacts on farming, roads and housing within the watershed. A land use management program would be developed in order to partially mitigate the disruption of land uses.

<u>Levee and Aqueduct Foundation Improvements</u>

No impacts on land use in the vicinity of the proposed levee and pile test study areas in the Delta were identified. Likewise, preliminary engineering design of any proposed facilities would have no effect on area land uses.

<u>Water Conservation, Water Reclamation and Water Quality Protection</u>

No land use impacts would be associated with the expanded water conservation, reclamation and quality protection elements of the WSMP. Site-specific impacts of water reclamation projects would be examined in subsequent environmental documents.

2.2.2 HYDROLOGY AND WATER QUALITY

Additional Terminal Storage

An additional terminal reservoir would have a beneficial effect on water supply in the District's service area in that it would reduce vulnerability to shortages during droughts or a failure of the Mokelumne Aqueducts or other major conveyance facility. The increase in local storage would extend, by up to six months, the period of time consumers could be served from the terminal reservoirs after a catastrophic failure of the Mokelumne Aqueducts.

Building an additional terminal reservoir could have short-term adverse impacts on water quality which are mitigable with appropriate construction practices and measures. Water quality impacts are related to potential spills of construction substances (i.e., cement, fuel, cleaning fluids, etc.) on-site and erosion of sediments into nearby waters of Upper San Leandro Reservoir or Pinole Creek.

Hydrology and water quality impacts associated with a proposed Los Vaqueros Reservoir are presented in Chapter 3 (p. 3-9 through 3-26) of the Los Vaqueros/Kellogg Project EIR. Both groundwater and surface water impacts due to land acquisition, interim watershed management, construction and operation of the reservoir were examined. The authors of the report found the potentially significant adverse impact of reduced groundwater recharge downstream from the proposed dam could be mitigated through releases from the reservoir to replenish downstream aquifers. Possible turbidity and other water quality changes during dam construction and releases of creek water as well as construction site runoff would be mitigated by use of sedimentation basins prior to discharge. Increased turbidity, sedimentation and possible fuel spill impacts on surface waters could be mitigated by appropriate on-site control measures.

Aqueduct Security

Implementation of the proposed preliminary engineering studies and design related to securing the Mokelumne aqueducts in the Delta region would have no impact on water quality or other water resources. If built, a secured aqueduct levee system through this area would have a beneficial impact on water resources for the region by reducing the risk of major outages in supply to the East Bay.

Water Conservation, Water Reclamation and Water Quality Protection

No adverse impacts on hydrology, water quality or other water resource concerns would be associated with implementation of expanded water source protection, conservation and reclamation measures. Further efforts toward water conservation and reclamation, with the intent to reduce peak and average water demand, would have beneficial impacts on the water resources of California in that more water could remain in the Mokelumne River for in-stream or other use. The amount of water available for municipal supply purposes during dry periods would be increased.

2.2.3 GEOLOGY AND SOILS

Additional Terminal Storage

The geologic resources of both the Buckhorn and Pinole inundation areas were found to be unremarkable and of no special value. No active faults pass through either dam site. There is no reason to believe that a dam at either site would be more vulnerable to damage under earthquake conditions than any other dam in California meeting similar seismic safety standards.

Soils, geology and seismicity impacts for a Los Vaqueros Reservoir are presented in Chapter 3 (p. 3-1 through 3-8) of the Los Vaqueros/Kellogg Project EIR. Like Buckhorn and Pinole dams, Los Vaqueros dam would be designed to withstand the maximum credible earthquake without failure, as required to meet Division of Safety of Dams standards.

Levee and Aqueduct Foundation Improvements

There could be a potentially adverse impact on soils of the Delta region, related to implementation of the pile testing activities. The intent of the test program is to determine the extent and magnitude of such potential geotechnical impact. The preliminary design package would incorporate measures to mitigate any adverse impacts found to be of significance.

Water Conservation, Reclamation and Protection

The water conservation reclamation and water quality protection elements of the WSMP would cause no adverse impacts on geology and soils of the region.

2.2.4 BIOLOGICAL RESOURCES

Additional Terminal Storage

The proposed terminal reservoir would inundate from 800 acres (Pinole) to nearly 1,200 acres (Buckhorn) of rural grassland terrain including some riparian habitat. The Buckhorn project would inundate 34 acres of riparian vegetation; the Pinole project about 54 acres. This loss could be partially compensated for by enhancement or creation of other riparian areas in the vicinity of either site. The District is currently developing a conceptual mitigation program for each candidate site. Once a site has been chosen, a detailed mitigation program will be developed in consultation with wildlife agencies. The purpose of the mitigation program is to create or enhance riparian habitat with a value equal to or greater than that lost.

No species listed as rare or endangered under the provisions of the Federal Endangered Species Act were found at either reservoir site. The Aleutian Canada goose, a federally listed species, uses a stock pond near the Pinole site during migration. The species would not be expected to be affected by dam construction if the suggested mitigation measures are adhered to. Habitat for a candidate species for federal listing, the Alameda striped racer, exists at both reservoir sites but no individuals were found. A stand of a second federal candidate species, the Northern California black walnut, would be inundated at the Pinole site. It is not clear whether the stand of trees is native or introduced. Only native trees are of interest to the wildlife agencies.

An isolated race or subspecies of steelhead rainbow trout inhabits Upper San Leandro Reservoir and spawns in its tributaries. An unknown proportion of the spawning habitat would be inundated by Buckhorn reservoir.

Biological resources of the Los Vaqueros Reservoir watershed area were identified and impacts and mitigation measures discussed in Chapter 3 (Plant Life, p. 3-27 through 3-59 and Wildlife 3-60 through 3-90) of the Los Vaqueros/Kellogg EIR. Substantial effects on the project's botanical resources were identified. Potentially significant adverse impacts on important plant communities, special status species and other important plant species in the area could be affected by watershed management practices involving grazing intensities, controlled burns, wind energy development and recreation. Changes in land

management would reduce the habitat of some wildlife species as well. Although grazing adversely affects streambanks and fish habitat, direct impacts on fisheries were not deemed significant. A number of mitigation measures which could be incorporated into the project design to reduce or offset the impacts were presented; however, significant adverse impacts on biological resources cannot be completely avoided. The measures primarily involved effective watershed management practices.

Levee and Aqueduct Foundation Improvements

No adverse impacts on vegetation, aquatic biota or terrestrial wildlife would be associated with the preliminary engineering activities for securing the Mokelumne aqueducts through the Delta. Implementation of a major levee improvement project involving new pipelines, at some future time, would require separate documentation of potential impacts on biological, as well as other natural, resources of the area.

Water Conservation, Water Reclamation and Water Quality Protection

No adverse impacts on area vegetation, aquatic, biota or terrestrial wildlife would result from the District's additional water quality protection, conservation and water reclamation measures. Individual wastewater reclamation projects would be the subject of separate environmental documentation.

2.2.5 TRAFFIC AND TRANSPORTATION

Additional Terminal Storage

During construction of a Buckhorn Reservoir, 120 to 240 truck trips daily would be added to present traffic volumes on Redwood Road in Castro Valley. Work crews would account for an additional 350 to 450 daily trips along Redwood Road during the construction period. Construction activity during the Christmas season could interfere with public tree sales at the Castro Valley Christmas Tree Farm on-site. Pipeline construction would further impact traffic and transportation activities through the Town of Moraga.

The Pinole project would require an estimated 40 to 80 truck trips daily and an additional 200 to 400 crew trips along Pinole Valley and Castro Ranch Roads. The latter roadway would be used as primary access for construction vehicles. Such increases would result in some congestion and delays on both roadways. Road improvements will probably be

necessary in order to accommodate heavy trucks required for hauling construction equipment, supplies and materials. Relocation of a 5.6-mile segment of Pinole Creek Road above the inundation zone would be required but service on the road would not be interrupted.

A number of mitigation measures to reduce traffic impacts during the construction phase are recommended including roadway improvements, signals and operational scheduling.

Operation of either proposed reservoir project would not have a long-term effect on area traffic or transportation.

Construction of Pinole or Buckhorn Reservoirs would take about four years. Truck and worker vehicle traffic on roads close to the site would increase congestion and inconvenience other road users. Pipeline construction through the Town of Moraga would also adversely affect traffic flow for several months. Mitigation measures such as prohibiting peak-hour or night truck movements and vanpooling workers would lessen adverse impacts. The impacts after mitigation would remain adverse but would be judged less than significant because they would be temporary.

Transportation related impacts associated with development and operation of a Los Vaqueros Reservoir have been presented in Chapter 3 (p. 3-120 through 3-122) of the Los Vaqueros/Kellogg EIR. Vasco Road would be relocated but would remain in continuous operation without loss of service. Construction and recreational vehicles would affect traffic and possibly accident rates although the level of impact was deemed mitigable through further studies and roadway improvements.

Levee and Aqueduct Foundation Improvements

During construction of the test levee section and pile testing station associated with the Mokelumne aqueducts security program there would be a minor temporary increase in Delta area traffic.

Water Conservation, Water Reclamation and Water Quality Protection

The proposed additional protection, conservation and reclamation measures would have no identifiable impact on traffic and transportation resources of the region.

2.2.6 NOISE

Additional Terminal Storage

Traffic, equipment and other construction-related noise associated with developing either terminal reservoir would be potentially significant but could be reduced somewhat through adoption of such measures as scheduling of deliveries, noise barriers, muffling and other mitigations. Adverse impacts on noise would be of a temporary nature. Operation of an additional terminal reservoir would have no effect on noise levels.

Noise-related impacts associated with construction and operation of a Los Vaqueros Reservoir have been discussed in Chapter 3 (p. 3-162 through 3-171) of the Los Vaqueros/Kellogg Project EIR. Both temporary and long-term noise sources were identified; none was determined significant.

Levee and Aqueduct Foundation Improvements

Preliminary engineering activities may have a short-term impact on area noise levels in the immediate vicinity of the testing sites which would not be considered significant. No long-term adverse noise related impacts are associated with future Mokelumne aqueduct improvements.

Water Conservation, Water Reclamation and Water Quality Protection

No adverse impacts on noise would be associated with the proposed additional water protection, conservation and reclamation measures.

2.2.7 AIR QUALITY

Additional Terminal Storage

Operation of a new terminal reservoir would have no adverse effect on regional climate or air quality. During construction, vehicular emissions would be increased, as would dust generation; however, these effects would be localized. If brush cleared from the site is

burned, then air quality would be adversely affected. Measures suggested in order to minimize air pollutant generation, include dust suppression, off-site haulage of brush rather than burning, and other mitigation measures.

Air quality impacts of a Los Vaqueros Reservoir project were presented in Chapter 3 (p. 3-148 through 3-161) of the Los Vaqueros/Kellogg Project EIR together with proposed construction-related control measures. Potential impacts were considered less than significant by the authors.

Levee and Aqueduct Foundation Improvements

The proposed preliminary engineering studies for securing Delta levees against seismic conditions along the Mokelumne Aqueduct would have no impact on air quality in the area.

Water Conservation, Water Reclamation and Water Quality Protection

Impacts on air quality of the region are not foreseen with adoption of the additional water protection, conservation and reclamation measures.

2.2.8 CULTURAL RESOURCES

Additional Terminal Storage

Either proposed reservoir project would inundate sites of potential archaeological interest, two at Buckhorn, one at Pinole. Although none is considered of unique or special historic or cultural interest, mitigation measures have been proposed if these or other yet undiscovered sites are found to be of interest. Measures include exploratory site excavation and recording prior to construction.

Impacts on cultural resources in the Los Vaqueros watershed area were presented in Chapter 3 (p. 3-95 through 3-108) of the Los Vaqueros/Kellogg Project EIR. A number of prehistoric (17) and historic (11) sites could be inundated by construction of the reservoir. Measures could be incorporated to reduce adverse impacts on cultural resources to less-than-significant levels.

Levee and Aqueduct Foundation Improvements

Cultural resources would not be affected by the preliminary engineering studies for aqueduct security in the Delta.

Water Conservation, Water Reclamation and Water Quality Protection

Cultural resources of the area would not be affected by the District's proposed water protection, conservation and reclamation measures.

2.2.9 VISUAL QUALITY

Additional Terminal Storage

Development of a new terminal reservoir would produce a permanent and significant change in the appearance of either site selected. A dam and reservoir would be more visually prominent than present rangeland. These changes in visual quality are deemed less significant for Buckhorn than the Pinole site because access to the former is more limited. Whether the changes are adverse or beneficial is difficult to determine as there is no agreement on the aesthetic value of artificial lakes on the California landscape. During dry periods when the reservoir is drawn-down the barren area visible around its perimeter would degrade visual qualities. Visual quality during construction would be temporarily impaired.

Aesthetic impacts from construction and operation of a Los Vaqueros reservoir were examined in Chapter 3 (p. 3-144 through 3-147) of the Los Vaqueros/Kellogg Project EIR. Adverse visual effects could be reduced through a series of mitigation measures; however, the visual appearance of the area would be permanently altered and the impact would remain significant in the judgement of the authors.

Levee and Aqueduct Foundation Improvements

Pile testing and other preliminary engineering activities associated with the Mokelumne aqueduct security program are not expected to have an appreciable effect on visual quality in the Delta area.

Water Conservation, Water Reclamation and Water Quality Protection

No impact on visual quality of the region is anticipated with implementation of the proposed additional water conservation measures.

2.2.10 PUBLIC SAFETY

Additional Terminal Storage

Under normal circumstances an additional terminal reservoir would have no effect on public health and safety. In the improbable event of a sudden and complete dam failure a flood wave would descend downstream with catastrophic consequences for life and property. While the risk of dam failure is very low in either case, it is apparent that the Buckhorn project poses somewhat less threat to public health and safety than Pinole, as substantially less population and property are located immediately downstream from the Buckhorn site. If a catastrophic failure of Buckhorn were to occur, however, it could be argued that Upper San Leandro and Chabot dams would fail as well, which would result in flooding of the more populated and industrialized San Leandro area.

Public health and safety impacts related to construction and operation of a Los Vaqueros Reservoir facility are discussed in Chapter 3 (p. 3-137 through 3-140) of the Los Vaqueros/Kellogg Project EIR. Potential impacts are related to dam failure from earthquakes, construction accidents and fire hazards, insect vectors and unsafe recreational activities. Sound reservoir management control measures were proposed to mitigate these impacts to less than significant levels.

Levee and Aqueduct Foundation Improvements

The preliminary engineering activities would not affect public health and safety.

Water Conservation, Water Reclamation and Water Quality Protection

The proposed water conservation and water reclamation activities would have no adverse impact on public health and safety. The water quality protection element of the WSMP would benefit public health.

2.3 SIGNIFICANT ADVERSE EFFECTS THAT CANNOT BE AVOIDED

The California Environmental Quality Act requires that significant adverse environmental effects that cannot be avoided must be identified in an EIR on a proposed project. Sections 15064 and 15065 of the State's guidelines for implementing the California Environmental Quality Act state that "A significant effect on the environment is defined

as a substantial or potentially substantial adverse change in physical conditions which exist in the area affected by the proposed project including land, air, water, minerals, flora and fauna, ambient noise and objects of historic or aesthetic significance." Economic impacts alone are not considered to be significant effects on the environment unless they result in significant physical impacts. While the guidelines provide some elaboration of what is meant by a "significant" impact, it obviously cannot be defined precisely. Initially it remains up to the author of the EIR and ultimately the lead agency to make a judgment on the matter.

In making the determination of significance it was assumed that to be judged "significant and unavoidable" an adverse impact would have to involve a permanent or severe temporary degradation in the quality of the environment or the destruction of important natural and cultural resources that cannot be eliminated or substantially lessened by the incorporation of mitigation measures. Based on this criterion, most of the impacts associated with the WSMP Phase I are not judged by the authors of the DEIR to be significant.

The WSMP element that has environmental consequences that could be judged significant is the proposed additional terminal reservoir storage project. A terminal reservoir at any of the three alternative sites would convert many hundreds of acres of undeveloped land to an artificial lake. One of the affected habitat types, riparian forest, is much reduced in California. What remains is considered by wildlife agencies to be sensitive habitat. Although loss of riparian habitat can be mitigated by creation of new habitat elsewhere, the argument can be made that a created habitat is less valuable than that destroyed and thus the net result is a significant adverse impact.

The extent to which an isolated subspecies of steelhead rainbow trout would be affected by construction of Buckhorn Reservoir is unknown. It is not known how important inundated spawning areas are to the subspecies. Impacts on the subspecies would be adverse and possibly significant.

A terminal reservoir at any one of the selected sites would substantially alter the visual resources of its area. These alterations in visual quality have not been judged to be significantly adverse because the changes would be seen by relatively few people and

there is no agreement on the aesthetic value of man-created water bodies in the California landscape. There would, however, be permanent and unavoidable changes in the visual environment.

2.4 POTENTIAL FOR GROWTH-INDUCEMENT

A project creates potential for growth-inducement when construction or improvement of infrastructure provides capacity for land development and population increases that exceed the planned growth of an area. The proposed water system improvements would have the potential to induce growth if they accommodated significantly more development than allowed by the current general plans of the cities served by the system. In that case, development might occur taking advantage of the excess capacity, despite community goals to the contrary. Ultimately, approval of development is a function of local planning commissions and city councils, not the District. The District responds to such plans, but does not initiate them.

Several elements of the WSMP could have consequences on growth and development within the area. The water conservation program would at least theoretically allow a larger number of homes and businesses to be served by the existing available water supply than at present. Similarly, the water reclamation projects would free more municipal water for new development by replacing some existing potable uses with reclaimed wastewater. However the savings achieved by the proposed conservation and reclamation measures would be only equivalent to an additional supply of 12 mgd. Because this is much less than the projected water demand associated with planned growth, these elements of the WSMP are not judged to have the potential to increase growth beyond that already planned.

Construction of a new terminal reservoir would provide backup storage in dry years and emergency outages sufficient to meet projected demand of 270 mgd by 2020.[5] Thus, to a large extent, the increased terminal storage will accommodate projected growth rather than providing for growth beyond that level already planned. Although additional terminal reservoir storage capacity is not judged to be growth-inducing, a new reservoir would remove an obstacle to growth. Growth in a particular area depends on economic and demographic factors and on the policies of local government. General plans prepared by

local governments will only come to fruition if the economy is robust enough to support new construction and if the necessary infrastructure is in place. Water supply is a key element of that infrastructure. If a new terminal reservoir, or some alternative to it that increases EBMUD's available supply, were not constructed, then growth in the District's service area could be limited by water availability beginning in the first decade of the next century.

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[1] For planning purposes, a projection of 270 MGD is being used which assumes a mid-range growth rate and implementation of EBMUD's current water conservation and reclamation programs.

[2] Usable storage is less than total storage because reservoirs cannot be drawn down completely.

[3] EBMUD Urban Water Management Plan, November, 1985.

[4] Contra Costa County Water District, Draft Stage 1 Los Vaqueros/Kellogg Project EIR, May, 1986.

[5] Based on a reservoir capacity of 144,000 acre feet and rationing of 25% during droughts.

3 WATER SUPPLY MANAGEMENT PROGRAM

3.1 INTRODUCTION

EBMUD supplies water to approximately 1.1 million people in portions of Alameda and Contra Costa Counties. The District's water supply source is the Mokelumne River, where water is stored at Pardee Reservoir for delivery to the East Bay via the Mokelumne Aqueduct. On reaching the Bay Area, the Mokelumne River water is temporarily stored in one of five terminal reservoirs in the East Bay hills before being treated and delivered to the District's customers.

EBMUD is facing several problems. The Mokelumne Aqueduct system, the District's water supply lifeline, crosses the Sacramento-San Joaquin Delta where the pipelines are vulnerable to damage in an earthquake or flood. As the Delta levees continue to deteriorate the risk of aqueduct failure increases and with it the risk of severe water shortages in the District's service.

Water demand in the District's service area continues to grow while the available supply declines. At present, the average daily demand met by the District's water supply system is about 220 mgd. By 2020, demand is expected to increase to between 270 and 280 mgd. During the same period, supply availability is expected to decline from 252 to 222 mgd as other users exercise their rights to Mokelumne River water. Without some improvement in the balance between supply and demand the frequency of water shortages during dry periods will increase.

As California becomes more densely populated and man-made chemicals become widely dispersed in the environment, it is becoming increasing difficult for EBMUD and other water agencies to serve water that is free of contaminants. The problem is compounded by the fact that federal and State drinking water standards and treatment requirements

are becoming more stringent. Various solutions to these problems have been examined by EBMUD. They include additional water conservation measures that would further reduce demand, substitution of reclaimed wastewater for some types of water use, strengthening of the aqueducts in the Delta, construction of additional terminal reservoir storage and use of a new source of water supply. The WSMP consists of a number of actions that EBMUD believes would best solve the problems that it faces.

This chapter is divided into two sections; first, a more detailed discussion of why the WSMP is needed and second, a description of its elements. A discussion of alternatives to the WSMP elements that were considered but rejected is included in Chapter 4.

3.2 NEED FOR THE WATER SUPPLY MANAGEMENT PROGRAM

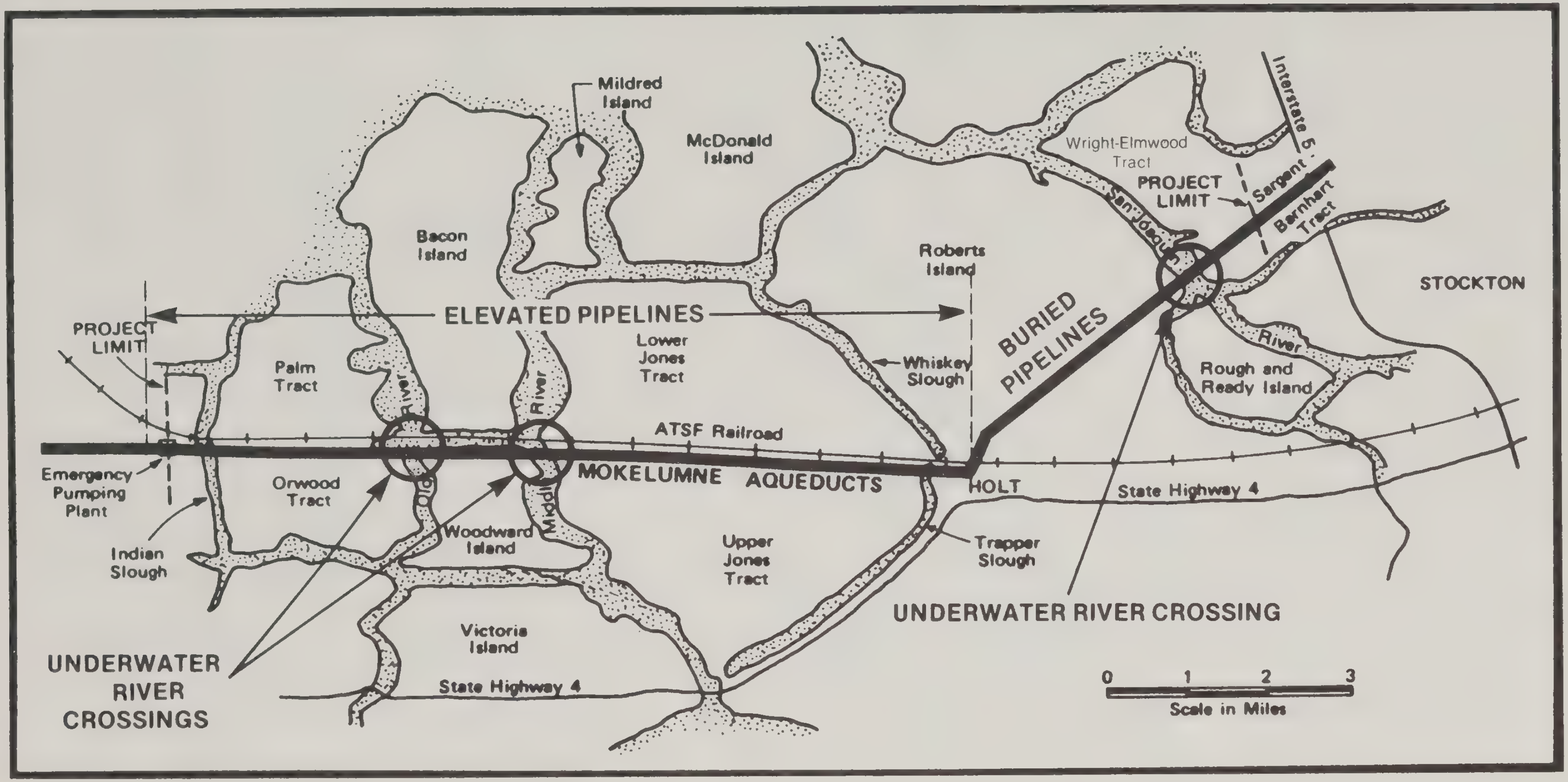
3.2.1 DELTA SECURITY

The Sacramento-San Joaquin Delta was a vast wetland prior to 1860. In the latter decades of the last century levees were built around delta islands to reclaim land for agriculture use. The cropland obtained in this way was some of the most productive in California. Continual use of the cropland has caused its surface to drop, partly as a result of the drying out and shrinkage of peat soils and partly as a result of wind-erosion. The land surface of most islands is now 20 to 25 feet below sea level and going down at a rate of 2 to 3 inches each year. The levees which were never of very sound construction and are themselves sinking 1 or 2 inches each year have become vulnerable to overtopping and drainage during earthquakes.

Because the District's Mokelumne Aqueducts cross the delta as shown in Figure 3-1, the deterioration of the levees is a matter of great concern to the District. The stake the District has in Delta levee protection was made clear in 1980 when Lower Jones Tract flooded and the railroad embankment adjacent to the aqueducts subsequently failed, allowing floodwaters to flow into Upper Jones Tract. Although there was deep scour around the pipe support piling, the pipes were not damaged due to two fortuitous circumstances: the flow through the break was reduced by the low water level on Lower Jones Tract and was deflected by two locomotives and a box car that fell off of the railroad embankment.

MOKELUMNE AQUEDUCTS IN THE DELTA

FIGURE 3-1



eip

Studies by the U.S. Corps of Engineers and the State Department of Water Resources in 1982 identified the serious problems with levees in the Delta and recommended various levels of improvements. Since that time EBMUD has contributed more than $1 million toward the cost of levee improvements. Efforts continue in the State legislature to provide funding for a Delta protection program. Even if such a program is authorized the high cost of levee repair make it unlikely that full protection can be provided. Levee failures can be expected to continue, perhaps at an increasing rate.

3.2.2 WATER SHORTAGE

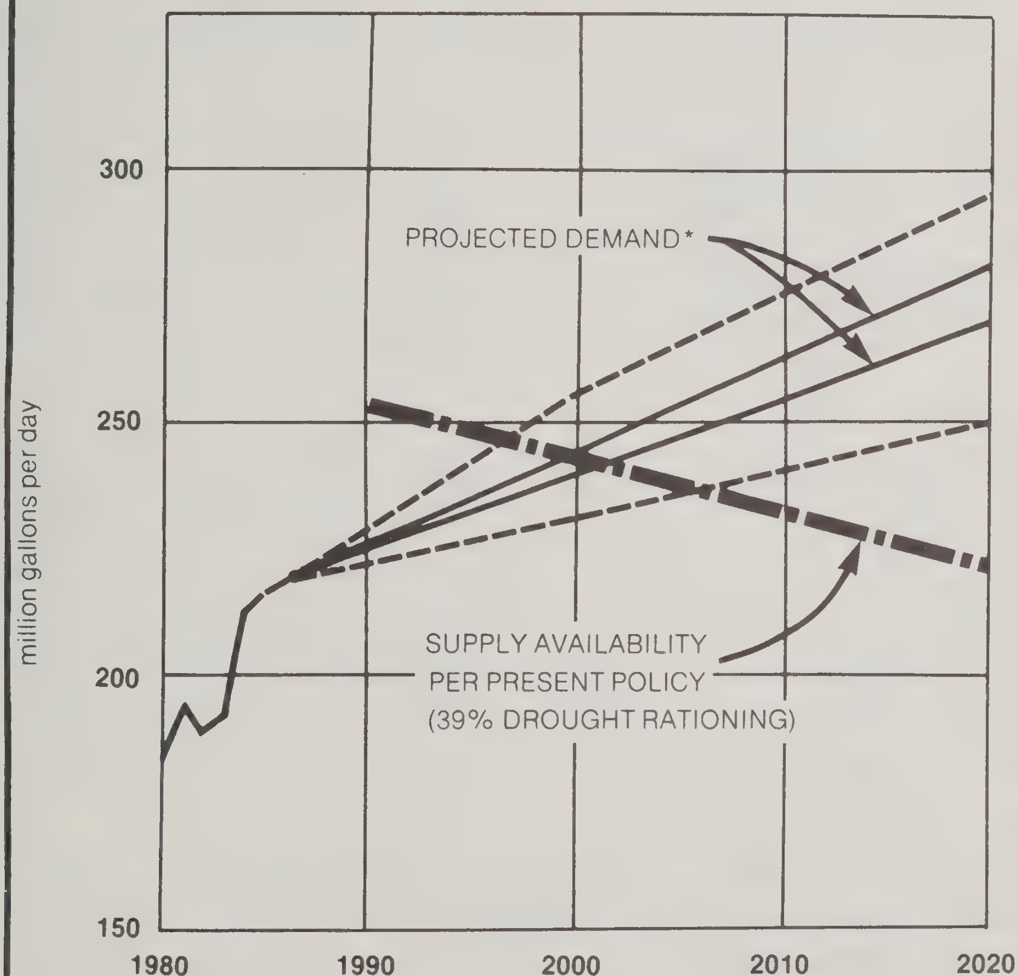
The future water requirements shown in Table 3-1 were determined by the District based on water demand projections, with a contingency added for variations in climatic conditions less savings that result from water conservation and reclamation measures. The present (1988) requirement averages 220 mgd. The water requirement for the year 2020 is projected to be between 270 and 280 mgd as shown in Figure 3-2. For planning purposes a projection of 270 MGD is being used, which assumes a mid-range growth rate and full implementation of EBMUD's current water conservation and reuse programs. EBMUD's ultimate boundary defines the planning limits of its future service area at 385 square miles. Service to areas beyond the ultimate boundary is not included in the projected demand.

Annexations to EBMUD are under the jurisdiction of the Local Agency Formation Commission (LAFCO) of Alameda County. It has relinquished jurisdiction to LAFCO of Contra Costa County for annexations within that county. Applications to LAFCO may be filed (1) by EBMUD at the request of a property owner, (2) by a city or county, or (3) directly by the property owner. Annexation to a city already served by EBMUD is automatic unless EBMUD objects, a process which does not involve LAFCO.

Increase in water demand is determined by the residential and commercial development planned and approved by the cities and counties within the District. New construction in existing communities is the predominant factor affecting future demand. Demand has been projected on the basis of population, housing, employment and land use projections by the Association of Bay Area Governments (ABAG) to the year 2005 for the area within the ultimate boundary. Longer term county projections by the State Department of

PROJECTED DEMAND

FIGURE 3-2



* Higher projection (280 MGD in 2020) assumes current conservation and reuse programs. Lower projection (270 MGD in 2020) assumes proposed conservation and reuse programs.

TABLE 3-1

WATER DEMAND AND REQUIREMENTS PROJECTIONS (MGD)

CATEGORY	1986	1990 LOW	1990 HIGH	2020 LOW	2020 HIGH
Customer Use (Metered)					
Residential - Single Family	91	87	99	114	129
- Multi-Family	31	30	31	32	37
Commercial & Institutional	32	26	30	32	41
Industrial - Oil Refineries	15	18	21	16	23
- Other	15	14	15	17	23
Park, Golf & Cemetery	12	9	10	11	13
Miscellaneous	2	2	2	2	3
Subtotal[1]	198	185	207	224	268
District Use	1	1	1	1	2
Unaccounted-for Water[2]	16	16	18	20	24
Total Demand[1]	215	203	227	247	294

	1990	2020
Planning Projection		
Average of Demand Range	215	270
Variance for Weather and Other Conditions	+10	+10
Projected Additional Savings		
- Water Conservation	-0.3	-4
- Water Reclamation	-0.2	-5
WATER REQUIREMENT[1]	225	270

[1]Totals may not equal sum of categories due to rounding.

[2]Difference between measured water delivered into the distribution system at the filter plants and the total of all customer billed quantities.

Finance were used for extension to the year 2020. The demand projection takes into account the differences in geographic, climatic, and land use characteristics across the EBMUD service area, which have a significant bearing on water use.

Unit water consumption for residential, commercial and industrial use is anticipated to continue rising during the next several decades due to such socioeconomic trends as more extensive landscaping and larger home lot sizes. Unit consumption values multiplied by the projected number of consumers results in the demand projections expressed in Table 3-1. The average demand for water is expected to reach 238 mgd by year 2000, and 270 mgd by year 2020. Making adjustments for variance in weather and other conditions as well as additional water savings anticipated from the proposed conservation and reclamation actions results in the projected water requirement of 225 mgd by 1990 and 270 mgd by 2020.

The water requirements expressed above are for the District's ultimate service area only, potential demand from outside the District's boundaries are considered separately. At present external demand accounts for 67 mgd which may more than double during the next 35 years. Over half of the potential demand derives from Contra Costa County Water District (CCWD). A study of water supply and quality needs was carried out by EBMUD and CCWD in 1984 concluding that potential benefits from a joint water storage project for both districts exist.

The water projects that comprise the proposed WSMP considered in this EIR have been developed for EBMUD requirements alone, however, one alternative project under consideration, Los Vaqueros Terminal Reservoir, involves joint supply to both EBMUD and CCWD.

3.2.3 PROTECTION OF PUBLIC HEALTH AND SAFETY

The District must, as a minimum, provide its customers with water that meets State and federal drinking water standards. However, it is the District's goal to provide its customers with the highest quality water reasonably available. As a result, EBMUD treated water is of a considerably higher quality than necessary to meet standards.

Drinking water quality can be maintained by protecting water sources from pollution and by treating the raw water to remove impurities. It is more desirable to prevent contamination of water supplies at the sources than to remove contaminants by treatment, although both activities play a role in most water systems. EBMUD, for example, uses both watershed management and protection, and treatment as a way of ensuring a safe, high quality water supply.

One way of protecting a water supply source is to own watershed land and control how it is used. EBMUD owns 26,000 acres of watershed land in the Bay Area. Of this 26,000 acres, 8,000 acres is in water surface. In addition, the East Bay Regional Park District and other public agencies own approximately 26,000 acres of open space contiguous to EBMUD's watershed lands. The Briones Reservoir watershed, for example, is almost entirely in public ownership.

In an urban area it is not always possible to reserve a watershed for water supply purposes alone. Multiple uses of a watershed, including urban development, often occur. In the case of San Pablo and Upper San Leandro Reservoirs, the cities of Orinda and Moraga lie within the watershed. Regardless of the level of watershed development, maintenance of water quality depends on careful watershed management. Management activities include erosion control, limits on development and land use, and patrolling to ensure restrictions on recreation use are followed.

Although EBMUD's treated water is of a higher quality than is required by State and federal standards, the District continues to investigate advanced water treatment technology. A proposed U.S. Environmental Protection Agency rule on surface water treatment would necessitate significant changes to EBMUD's water treatment processes, requiring the use of ozone or chloramines instead of chlorine as the principal disinfectant. Pilot testing and preliminary design of ozone facilities will start in 1988.

3.3 WATER SUPPLY MANAGEMENT PROGRAM ELEMENTS

The District's proposed WSMP, designed to solve the problems noted above consists of five elements:

- o Additional Terminal Reservoir Storage Capacity
- o Levee and Aqueduct Foundation Improvements in the Delta
- o Water Conservation Measures
- o Water Reclamation Activities
- o Protection of Water Quality

The following subsections provide a description of each basic element. Brief descriptions of the WSMP elements are included in this chapter with further detail provided in later chapters.

3.3.1 ADDITIONAL TERMINAL STORAGE

EBMUD has five terminal reservoirs in the East Bay hills which collectively provide about 138,000 acre-feet (AF) of usable raw water storage. There is also some unusable storage; water at the bottom of the reservoirs that is inaccessible for supply purposes. The functions of the terminal reservoirs are two-fold; provide standby storage for use in case of water supply outages and in critically dry years, and to adjust (by regulating) delivery of the Mokelumne supply through storing the imported water and local runoff in the winter for use during peak demand summer periods.

Twenty-six candidate sites for additional terminal reservoir storage have been considered by the District. Three sites (Buckhorn, Pinole and Los Vaqueros) were found to represent the best alternatives based on their low total unit cost ($/volume of increased supply) and environmental impacts for both construction and operation. In addition, these sites offer better operational and security advantages than other alternatives considered.

From an operational standpoint, the Buckhorn Reservoir project presents advantages over other alternatives. Buckhorn Reservoir would have an elevation of 745 feet above mean sea level. Although water would be pumped into the reservoir, it would flow by gravity from the impoundment to any of the treatment plants within the service area, thereby increasing operational flexibility and system reliability during extended water supply outages. The reservoir would be operated as a standby system, providing water only during dry periods or during extended supply outages. Both reservoir site and surrounding watershed, located in a remote rural area south of Moraga, would be within District lands, assuring greater protection of water quality.

EBMUD is currently performing technical feasibility studies on the preferred sites. While Buckhorn appears to the District to be the most promising reservoir site, the other alternatives are still under evaluation.

3.3.2 LEVEE AND AQUEDUCT FOUNDATION IMPROVEMENTS

An element of the proposed WSMP involves conducting preliminary engineering studies and design to prepare for construction of Mokelumne Aqueduct improvements. The studies include pile testing activities as well as formulation of design criteria for a proposed new facilities to replace vulnerable portions of the existing conveyance system where it crosses the Delta. It is estimated that these preliminary engineering study and design activities will require three to four years to complete.

The proposed program would include levee studies, pile test studies and preliminary design of remedial or new facilities.

3.3.3 WATER CONSERVATION

The District's proposed water conservation program involves continuation of previous water conservation actions supplemented with additional measures required to reduce the rate of increase in demand as the number of its customers increases. A water conservation program was adopted by the District as part of its Urban Water Management Plan in 1985 and is currently being implemented.

The proposed program will involve both demand management (i.e., customer-related) and supply-side (e.g., leak detection and other internal District components. The program elements can be categorized as follows:

- Device Distribution — Provide free water saving devices for existing customers to retrofit showers and toilets.
- Water Audits — Offer to review indoor water use of any customer and commercial/industrial processes to suggest ways of improving water use efficiency.
- Water Efficient Landscapes — Promote use of low-water-consuming-plants and efficient irrigation for all existing customers through rebates and free consultation. Require these practices in new residential, commercial, institutional, and industrial developments through enforcement of regulations and by offering incentives through discounts or rebates.

- o <u>Public Education</u> — Expand current efforts and produce new exhibits, brochures, and school material to further encourage efficient water use.
- o <u>District Activities</u> — Reduce water use at all District facilities and pursue pricing and pressure reduction policies to encourage greater consumer conservation.

The District's annual cost for the proposed water conservation program, including all current activities that are continuing, is currently (1988) estimated at $1.2 million. Costs in forthcoming years may be somewhat less once materials are developed and all program elements are fully implemented.

The existing water conservation program is designed to reduce demand by 4 mgd (approximately 2% of customer demand) by the year 2020. The proposed water conservation program would reduce demand by an additional 3 mgd for a total of 7 mgd (3.5% of customer demand) by 2020.

The proposed water conservation program represents an expansion of existing activities. Some of the measures have already been implemented but it is too early to tell whether they will achieve their intended objectives. The program will increase public awareness of water and its use, and encourage conservation primarily through education and incentives, as opposed to regulation and restriction.

3.3.4 WATER RECLAMATION

The third element in the WSMP involves continuation and expansion of the District's present water reclamation activities. EBMUD is currently studying new projects which may be added to its ongoing water reclamation program. These additional projects are listed in Table 3-2. Potential water savings are estimated to be 5 mgd or, translated to annual quantities, approximately 6,000 acre-feet/year (AFY).

The reuse markets being considered include both industrial cooling and process water needs at Chevron's Richmond Oil Refinery and landscape irrigation requirements at the City of Oakland's Lew Galbraith Golf Course and elsewhere. These projects would more than double the amount of wastewater presently reclaimed within the EBMUD system.

TABLE 3-2

POTENTIAL WATER RECLAMATION PROJECTS

Project/(Pot. Savings)[1]	Description/Activity
Chevron Oil Refinery (5260 acre-ft/yr)	Reclaimed water from the West Contra Costa Sanitary District may be used in cooling processes at Chevron's Richmond refinery. A pilot facility to determine the feasibility of using reclaimed water has recently been completed.
Galbraith Golf Course (160 acre-ft/yr)	Project would use reclaimed water from the City of San Leandro's wastewater treatment plant for irrigation of the City of Oakland's Lew Galbraith Golf Course. EBMUD has developed a facility plan for the project and is preparing CEQA documents and negotiating with the golf course.
San Ramon Valley (N/A)	Reclaimed wastewater from the Dublin-San Ramon Services District would be used for irrigation of golf courses, parks, playgrounds and schoolgrounds.

[1]Potential water savings expressed in acre-ft. per year.

Additional activities that constitute a part of the Water Reclamation element of the Phase I Program involve pricing policies and reuse incentive charges. A general policy for the pricing of reclaimed water is now under consideration. Experience indicates that reclaimed water rates must be lower than alternate potable supplies in order to compensate users for minor increases in operating costs and risks to their processes as well as to stimulate demand. The intent of a pricing policy is to maximize recovery of the District's project costs while still providing the necessary incentives to use reclaimed water.

3.3.5 WATER QUALITY PROTECTION

As the final element in the WSMP, EBMUD intends to further its water quality protection activities through acquisition of additional watershed lands and treatment process improvements. This element of the Program is a continuation of the agency's current source protection, watershed management and treatment plant activities.

Watershed management could be improved by acquisition of watershed lands currently in private ownership which have potential for development. Ownership of the land extending to the ridgelines around the existing terminal reservoirs to the maximum extent possible would help assure that the high quality of stored water can be maintained into the future. The proposed acquisition involves 322 acres of land in the San Pablo and Briones watersheds. Additional land acquisitions are proposed if the Buckhorn or Pinole Reservoir projects are implemented; in the case of Buckhorn Reservoir, purchase of an additional 678 acres would result in District ownership of the entire watershed. Purchase of 2,687 acres of upstream lands would be proposed for full watershed protection of Pinole Reservoir.

Extensive alternative water treatment technology evaluations are also part of this element of the program. The District intends to further its studies and assessment of the membrane filtration process for removal of turbidity, bacteria, Giardia and other particulates with the addition of coagulants. Reducing chemical use is consistent with the District's objective of minimizing the amount of chemicals introduced into the water treatment process.

4 ALTERNATIVES TO THE WATER SUPPLY MANAGEMENT PROGRAM

4.1 ALTERNATIVES CONSIDERED BUT REJECTED

Before selecting the WSMP, EBMUD examined a number of conceptual alternatives that would meet at least some of its goals. These alternatives are discussed below together with the reasons why they were considered less advantageous than the WSMP. Conceptual alternatives are discussed in three groups: those that increase security of the existing supply, those that reduce water shortages and those that reduce public health and safety concerns. A final section discusses alternatives to individual elements of the proposed WSMP.

4.2 NO PROJECT ALTERNATIVE

EBMUD could choose to take no action with respect to the problems described in Chapter 3. If no action was taken the vulnerability of the Mokelumne Aqueducts in the Delta can be expected to gradually increase as the levees deteriorate. The probability of levee failure and a consequent temporary outage of the Mokelumne Aqueducts would increase. Depending on the cause of the failure, the aqueducts could be out of service for 4 to 17 months. A low or moderate-level earthquake of an intensity that might be expected to occur once every 23 years could produce an outage lasting up to 10 months. A more severe earthquake of an intensity that might be expected to occur every 83 years could produce a 13-month outage. During a 13-month outage, customers would be subject 63% supply cutbacks at the present level of demand and 69% cutbacks at the 2020 level of demand.

Without action to increase the available supply, water shortages during dry periods will become more frequent. As time passes progressively more homes and businesses would be relying on a gradually diminishing supply. At some time in the future, probably in about 2005, the District would have to cease supplying water to new customers or accept more drastic supply cutbacks in dry years.

The District is fortunate in having very high quality water available to it. If no action to protect water quality was taken beyond the level of the District's present practices it is unlikely that water quality would suffer drastically. It is, however, the District's policy to provide the highest quality water possible and thus some incremental deterioration could be expected if no action is taken. Violations of increasingly stringent State and federal drinking water standards could also occur.

4.3 ALTERNATIVES THAT INCREASE SECURITY OF SUPPLY

4.3.1 MOKELUMNE AQUEDUCT REPLACEMENT

The existing Mokelumne Aqueducts could be replaced by a new elevated aqueduct along an approximately parallel alignment that would withstand the maximum credible earthquake and floods without extensive damage. The cost of the new aqueduct is estimated to be $265 million. The environmental impact of this alternative would be less than that of the WSMP because no new land would be inundated. Field testing and preliminary engineering as described in Chapter 6 would be necessary before this alternative could be implemented.

4.3.2 AMERICAN RIVER AQUEDUCT

If and when EBMUD proceeds with construction of a delivery system for American River water, it could build a short aqueduct from the Folsom South Canal to the existing Mokelumne Aqueduct upstream of the Delta or an aqueduct that skirts the Delta to the north. The latter option would provide the District with two independent aqueducts; the new northerly aqueduct would be far less vulnerable to damage in natural disasters than the present aqueducts. Because simultaneous damage to both aqueduct systems would be very improbable, the District's overall vulnerability to interrupted supply would be minimal. This alternative is infeasible at present because of unresolved legal problems associated with EBMUD's use of the American River as a supply source.

4.3.3 TEMPORARY USE OF AN ALTERNATIVE SUPPLY

EBMUD could access an alternative water source in the event of a failure of the Mokelumne aqueduct system. The alternative water source would be used only until the existing pipelines were repaired. Possibilities include direct use of water from the western Delta by EBMUD or arrangements with other water agencies to share their water

sources or delivery systems. Direct use of western Delta water may be infeasible in the aftermath of a severe earthquake or flood because the intrusion of salt water as a result of the collapse of levees would make Delta water unsuitable for drinking. While some neighboring agencies may be able to supply small quantities of water in excess of their own needs, EBMUD has determined that the amount involved would be insufficient to meet demand in the District's service area.

Additional water could be obtained from the southern Delta, where water quality would be less affected by salt water intrusion, perhaps via the South Bay Aqueduct. The quality of this supply would, however, be much lower than that of Mokelumne River water. For this reason EBMUD has concluded that this alternative, although inexpensive, would be inconsistent with its goal of providing customers with the highest quality water available.

4.4 ALTERNATIVES THAT REDUCE WATER SHORTAGES

4.4.1 NEW SOURCE OF SUPPLY

Since 1970, EBMUD has had a contract with the U.S. Bureau of Reclamation for water from the American River. However, the facilities needed to deliver the water to the East Bay have not been built because of litigation. If delivered, the American River water would add up to 134 mgd to the District's available supply. Although there are indications that the litigation may soon be resolved, the feasibility of obtaining American River water in the next decade remains uncertain.

The legal difficulties associated with the American River supply could probably be resolved rapidly if the District chose to divert its contracted-for water from the Sacramento River or the Delta rather than upstream of the City of Sacramento. The District does not wish to do this because it would be inconsistent with its goal of providing consumers with the highest quality water available. Water taken from below the City of Sacramento or from the Delta would be of lower quality than American River water taken from a more upstream location. American River water is of very high purity because it originates as snowmelt in an almost undeveloped watershed, whereas Delta or Sacramento River water, while satisfactory as a drinking water supply, is more subject to contamination by substances originating from agricultural and urban development.

4.4.2 INTENSE WATER CONSERVATION MEASURES

Although water conservation obviously does not add to the total amount of water available to the District, it can increase the number of homes and businesses that the existing water supply can support. By reducing demand, water conservation delays the time at which total demand begins to approach the available supply.

The WSMP includes a package of water conservation measures that are estimated to reduce demand by 7 mgd in the year 2020. This element of the WSMP would delay the time at which total demand will match supply availability by three to four years. EBMUD considered a package of more intense water conservation measures that would reduce demand in 2020 by greater amounts. A disadvantage of the more intense conservation measures is that they are of unproven effectiveness in widespread practice and that, unlike the measures in the WSMP, they begin to noticeably affect the lifestyles of consumers. Furthermore, by increasing the number of water users relative to the District's available supply, the opportunity for relatively painless cut-backs during dry years is reduced. For these reasons, the District decided to opt for moderate, voluntary conservation measures rather than intense water conservation actions.

4.4.3 EXPANDED WATER RECLAMATION MEASURES

Like water conservation, water reclamation does not increase the total amount of water available to the District but it can increase the number of homes and businesses that the existing supply can support. It does so by using some of the water twice; first as drinking water, and second for a purpose that does not demand the highest water quality.

Although EBMUD has been exploring water reclamation options for many years they are limited by the lack of a market for large volumes of non-potable water within a short distance of the EBMUD wastewater treatment facilities in Oakland. At present wastewater reclamation saves about 5 mgd of potable water; this amount will increase to 10 mgd when projects now under construction become operational.

A number of other reclamation projects with the potential to save an additional 6 or 7 mgd of potable water, other than those included in the WSMP are being studied, but their feasibility is unknown. Overall it is apparent that while it is District policy to substitute

reclaimed water for potable water wherever practical and economically feasible, the opportunities for doing so are limited. While water reclamation can play an important role in meeting future demand but it cannot meet it alone.

4.4.4 EXCHANGE OF WATER WITH WOODBRIDGE IRRIGATION DISTRICT

The Woodbridge Irrigation District obtains its water from the Mokelumne River below EBMUD's reservoirs. EBMUD is obliged by law to release sufficient water from its reservoirs to meet the irrigation district's requirements. Under the exchange concept EBMUD would build or finance the construction of a pipeline from the Delta to the Woodbridge Irrigation District. During dry years Woodbridge would be supplied with Delta water, allowing EBMUD to divert larger amounts of water from its Mokelumne River reservoirs to the East Bay. The principal disadvantage of this alternative is that it would reduce flow in Mokelumne River between Camanche Reservoir and the irrigation district's diversion point. The flow reduction in dry years would have an adverse impact on the fishery and riparian vegetation and would probably be opposed by wildlife agencies.

4.5 ALTERNATIVES THAT REDUCE PUBLIC SAFETY AND HEALTH CONCERNS

It is EBMUD's policy to provide its customers with the highest quality water available to the District. The only alternatives to the element of the WSMP designed to protect water quality are no action and actions similar to those in the WSMP but more intense. The no action alternative was discussed earlier. More intense action could involve additional land acquisition for watershed protection, increased restrictions on watershed land use, intensified erosion control and accelerated treatment improvements.

4.6 ALTERNATIVE TERMINAL RESERVOIR SITES

Before concluding that the Buckhorn, Pinole and Los Vaqueros sites were the most suitable for additional terminal storage, EBMUD considered 26 possible reservoir sites. Sites in western Contra Costa County included several variations of Pinole Reservoir and reservoirs at Tice Valley, Canada del Cierbo and Rodeo Canyon. Sites in northern Alameda and southern Contra Costa County included an expansion of Upper San Leandro Reservoir, reservoirs at Cull Canyon and Bollinger Canyon, and reservoirs on Kaiser and Bolinas creeks. In eastern Contra Costa County sites considered included Sidney Flat, Curry Canyon, Michell Canyon, Alamo Creek, Bailey Road, Nichols, Morningside,

Tassajara and Kirker. For cost, environmental and operational reasons they were deemed less satisfactory than the three alternatives addressed in this EIR.

5 TERMINAL RESERVOIR STORAGE

5.1 DESCRIPTION OF PROPOSED PROJECTS

5.1.1 BUCKHORN FACILITIES

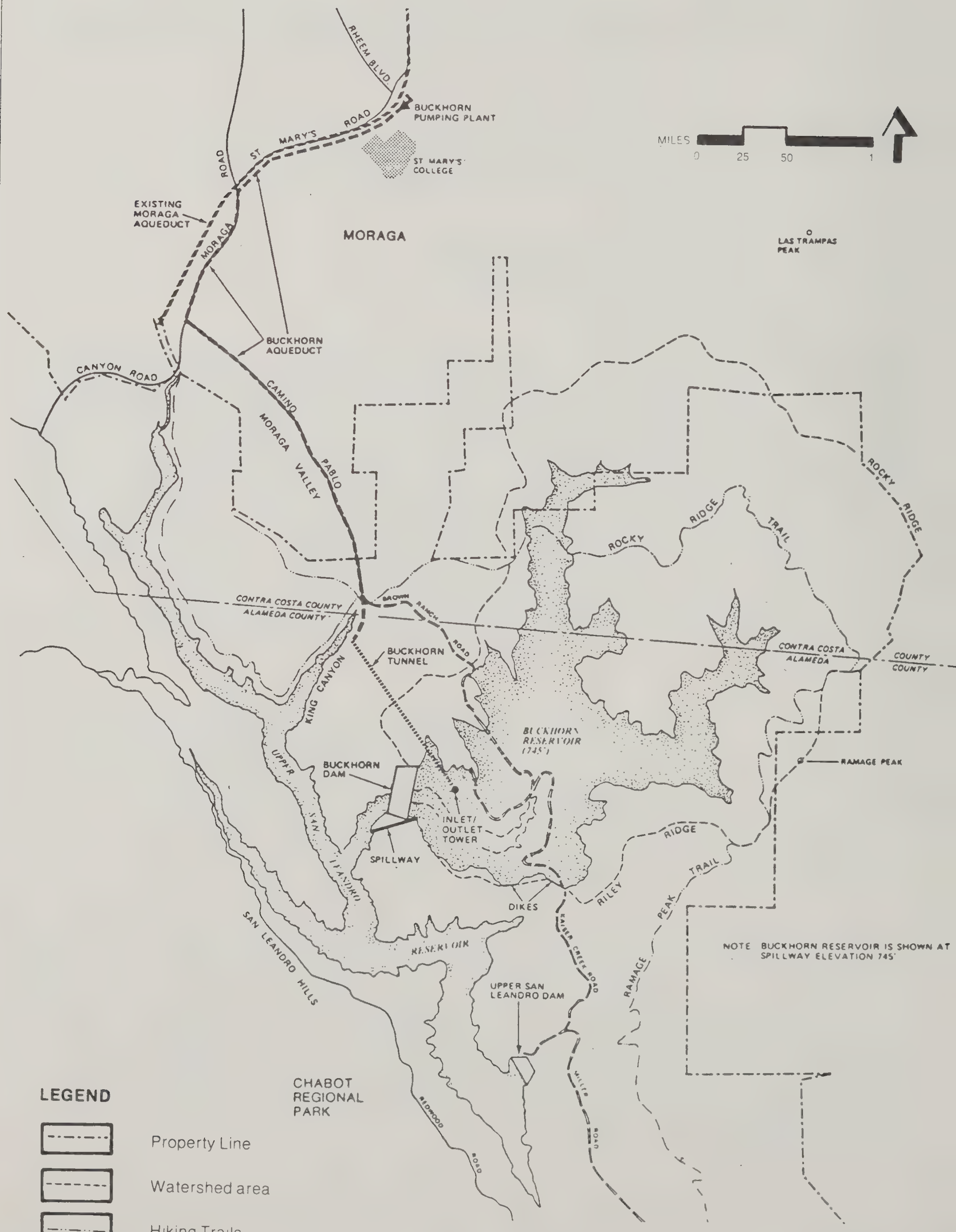
The proposed Buckhorn Reservoir site is shown in Figure 5-1. It is located below the confluence of the Buckhorn and Kaiser Creeks on the water filled northeastern arm of Upper San Leandro (USL) Reservoir. The watershed area contributing to the proposed reservoir site constitutes about 1/6th of the total USL watershed catchment area. Various dam heights/reservoir capacities were considered from a 680-foot msl spillway elevation with an 80 thousand acre-feet capacity reservoir to a 745-foot msl spillway elevation with a 145 thousand acre-feet capacity reservoir. This EIR documents the potential impacts of constructing a reservoir between 680 feet and 745 feet. A dam of this size would require two small rockfill dikes on a low ridge to the south side of the reservoir.

The main dam, a zoned earthfill structure with crest elevation between 695 and 760 feet msl, would have a crest length between 1,265 and 1,600 feet and a maximum embankment height at axis center line of between 305 and 370 feet Two rockfill or rolled compacted concrete dikes, 630 and 760 feet in length, and 30 and 60 feet in height, would be required along the reservoir's south side ridge for the larger (745-foot elevation) dam.

Upstream and downstream coffer dams would be required as well to permit dewatering of the dam site during construction. The downstream coffer dam would be a rockfill structure built in approximately 70 feet of water, while upstream would be an earthfill structure 60 feet in height with a crest elevation of 500 feet. Material for the core zone of the main dam, and upstream/downstream shell zones should be available from upstream borrow sites. Processed aggregate for rock drains, filter sands, transition zones and the dikes would need to be imported.

BUCKHORN RESERVOIR SITE PLAN

FIGURE 5-1



LEGEND

Property Line

Watershed area

Hiking Trails

Unimproved Road

A 1,620-foot long spillway would be located in the left abutment of the main dam which will require a large cut on the south side. A stilling basin would lie just above the USL Reservoir elevation of 460 feet msl, and rip rap would extend below the water line. The new spillway would be approximately 30 feet wide with 1-foot high walls, somewhat smaller than the existing USL spillway.

Tie-in to the existing Moraga Aqueduct system would be via an inlet and outlet (I/O) tower placed near the right dam abutment and construction of a 5,900-foot long tunnel that would "daylight" near the King Canyon arm of USL Reservoir. A blow-off structure at this site would permit supplying the USL Filter Plant via USL Reservoir and draining Buckhorn to the 480-foot elevation. Water below this elevation would be "dead" storage (approximately 2,000 acre-feet) requiring pumping for removal. With a maximum depth of 40 feet, the dead storage pool would be expected to gradually fill with silt. The I/O tower would be 20 feet in diameter and stand 295 feet high with six gates. A 60-inch butterfly valve would be provided at the tower/tunnel interface to allow closure of the tunnel for maintenance purposes. The 5,900-foot long tunnel would be excavated by 9-foot diameter tunneling machines working from both ends (i.e., King Canyon and the reservoir tower). The tunnel would be temporarily shored with ribbed lining plate and completed by installing 90-inch mortar-lined steel pipe, on an approximate slope of 0.2%, thereby permitting rail-based tunneling operations. Excavated material would be used at the dam, while at the King Canyon end disposed of at an adjacent spoils area.

Five tunnel alignments were evaluated in a Geologic Reconnaissance Study in June, 1987. The preferred location passes through only one geologic formation, the Claremont formation. The other alignments cross up to four geologic units and a fault zone, and traverse beneath thin ground cover. The portals of these alternative alignments also lie in the base of a landslide area. An alternative pipeline alignment to reduce the length of tunnel was also considered. This alignment extended along USL Reservoir but was eliminated from further consideration because it did not shorten the tunnel enough to reduce cost significantly. In addition, the portal of this alignment would not provide adequate space for a tunnel staging area.

A Buckhorn Pumping Plant, located anear St. Mary's College in Moraga (see Figure 5-1), would convey up to 103 mgd (design capacity) of flow from the Moraga Aqueduct through 23,000 feet of 72-inch steel pipeline for release to Buckhorn Reservoir via the King Canyon tunnel. The pumping plant, containing four vertical turbine pumps with a total installed horsepower of 5100 hp, would be installed partially or fully above ground on a 1.5-acre site adjacent to Saint Mary's College. The 80-inch diameter pipeline would be aligned within the Saint Mary's, Moraga and Camino Pablo Road public utility 60 to 100-foot rights-of-way.

When necessary, water from Buckhorn Reservoir would be delivered by gravity back through the tunnel, the new pipeline, and the existing Moraga Aqueduct to the District's filter plants. The Buckhorn pumping plant would be located at the high point of the Moraga Aqueduct resulting in lower energy costs to fill the proposed Three alternative locations for the pumping plant were also considered. The selected location further eliminates the need to create a closed piping system that would require a large surge stack and dissipator at St. Mary's College.

Both construction and permanent access to the dam would require building a 2.3-mile long paved access road from USL Dam to the proposed dam site along, for the most part, existing fire trails. The access road would extend along Kaiser Creek and Big Burn Roads, cross the two proposed south side dikes and pass over the new dam spillway by bridge then continue along the crest terminating near the northside I/O tower.

Construction of Buckhorn Reservoir would require relocation of an estimated 26 Pacific Gas and Electric high voltage transmission towers. In addition, several miles of fire trails within the impoundment area would have to be relocated. No pipelines, other underground utilities, or surface structures are known to exist within the proposed inundation area.

Purchase of approximately 72 acres of undeveloped land owned by Carr Ranch at the northern end of Buckhorn Reservoir would be necessary in order to construct the reservoir. The proposed pumping plant in Moraga would require an additional 1.5 acres of undeveloped land presently owned by St. Mary's College. The pipelines would be within public road right-of-ways or on District property. The tunnel and dam site are also on District property with the exception of the 72-acre north end inundation area.

5.1.2 BUCKHORN SITE CONSTRUCTION

Construction of Buckhorn Reservoir would take approximately four years including site preparation activities. Construction of the main spillway dikes, dam and appurtenant works (i.e., pump station, tunnel, pipelines, etc.) would require an estimated two and one-half to three years to complete under anticipated conditions.

The first year of construction would be devoted to site preparation including access road improvements, clearing, borrow site and staging area development and mobilization of equipment. Excavation and processing of borrow material would follow site preparation activities and be carried out simultaneously with dam construction activities. An upstream coffer dam would be placed first followed by a downstream coffer dam, dewatering and subsequent excavation for the main structure's foundation. Two small rockfill dikes would be constructed simultaneously with the main earthfill structure over an estimated 12- to 18-month period during which the tunnel, tower and pipeline work would also be completed. Construction of the spillway, tie-in pipeline, and Moraga pump station would be completed during the fourth year of the project.

An estimated 13 million cubic yards of material for the main dam would be obtained from the dam foundation excavation and from one or more borrow sites located upstream of the structure and within the confines of the reservoir. Cement, processed aggregate and other construction materials would be conveyed to the site along the new access road by heavy payload trucks. Construction traffic would be limited to daylight hours only but occur throughout the year with exception of weekends. Truck traffic is anticipated to reach on the order of 60 vehicle trips per day for cement, processed aggregate, and other imported materials during the dam construction phase of the project.

A construction staging area would be developed on a 3-acre site located at the terminus of Miller Creek Road and the new access road entrance just below USL dam. The site would encompass a concrete batch plant, vehicle parking, material stockpiles, equipment storage, repair yard and office. The batch plant production rate would be approximately 250 yd (bulk)/hr. Water would be provided by withdrawals from the Upper San Leandro Reservoir. Electric power for the concrete batching equipment would also be required.

Material excavation at the dam and upstream borrow sites would be performed by heavy construction equipment that would include power shovels, bulldozers, scrapers and cranes. Some blasting might be required. A list of probable equipment, quantity and size is presented in Table 5-1. Temporary haul routes from borrow areas to the dike and dam sites would be developed within the confines of the reservoir.

Construction of the proposed dam and appurtenant structures is estimated to require a force of approximately 270 workers over a three to four year period. For a portion of the project, possibly extending up to two years the workforce might operate on double-shift. Construction activities are not envisioned to occur during weekends or holidays but would take place year round.

The estimated cost for construction of the project is approximately $152 million based on current (1988) prices.

5.1.3 PINOLE FACILITIES

The Pinole Dam site, shown in Figure 5-2, is located on Pinole Creek between Pinole and Sobrante Ridges northeast of San Pablo Reservoir and southeast of the City of Pinole. The proposed zoned earthfill embankment dam would have a crest length of 1,700 feet and a maximum height of 185 feet at the centerline of its axis. With a spillway crest elevation of 340 feet msl, the reservoir would provide a maximum capacity of 50 thousand acre-feet with 44 thousand acre-feet, of usable storage. Dead storage of 6,000 acre-feet corresponds to a reservoir level of 251 feet msl; below this level, water would have to be pumped for removal. The reservoir surface area would encompass approximately 860 acres, when full.

A concrete lined chute spillway, situated adjacent to the east abutment, would have a discharge capacity of 3,000 cubic feet per second (cfs). This capacity is capable of handling a one-in-a-thousand year flood; the spill to be discharged into Pinole Creek, about 1,000 feet downstream of the dam. An inlet/outlet (I/O) tower, situated near the left abutment, would serve three functions by providing:

- inlet flow to the reservoir
- releases to San Pablo Reservoir or the Sobrante Filter Plant
- releases to Pinole Creek

TABLE 5-1

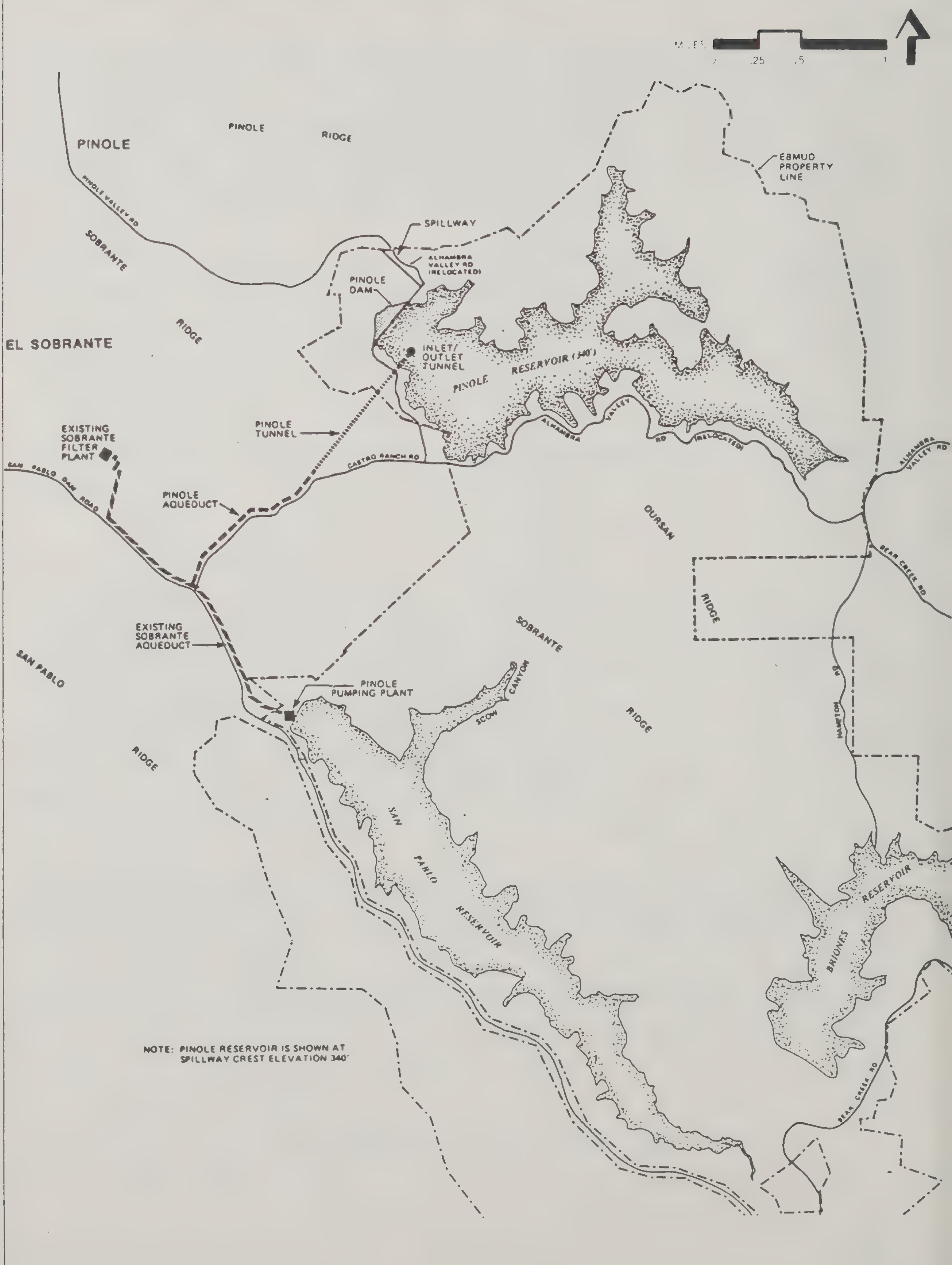
CONSTRUCTION EQUIPMENT LIST

Quantity	Description	Size
8-12	Bulldozers	D-8 to D-9
20-25	Scrapers	25-35 CY
3	Vibrating Rollers	10-15 Ton
3	Sheepsfoot Rollers	10-15 Ton
3	Hydraulic Excavators	1½-3 CY
3	Hydraulic Cranes	18-30 Ton
1	Truck Crane	80-100 Ton
3	Blades	80-100 Ton
8-12	Air Compressors	250-600 CPM
6	Welders	400 A
3	Rock Drills	to 6"
1	Tunnel Drill	9 ft 0
4-6	Loaders	6-10 CY
8-10	Off-Highway Trucks	35-50 Ton
15-20	Highway Vehicles	1-1½ Ton
15	Storage Containers	150 CY
1	Concrete Batch Plant	
	Miscellaneous[1]	

[1] Additional equipment would include, one or more conveyors, dragline, buckets, forklifts, generators, hoist, hoppers, office trailers, 3/4 ton pickups, fuel and water trucks, pumps, scales, tool houses, etc.

PINOLE RESERVOIR SITE PLAN

FIGURE 5-2



The tower would be located on the existing Alhambra Road, approximately 2,200 feet northwest of the intersection of Castro Road and Alhambra Road. A 78-inch diameter tunnel, 4,300-feet long and running in a southwesterly direction, would connect the I/O tower to a 72-inch diameter steel pipeline. The pipeline, approximately 5,000 feet long, would extend from the south portal of the tunnel to Castro Road and connect to the Sobrante Aqueduct at the intersection of Castro Road and San Pablo Dam Road.

The Pinole Pumping Plant would be located on District property (Figure 5-2) just below San Pablo Dam Road, southwest of San Pablo Creek and the Sobrante Raw Water (SRW) Aqueduct. The 120 mgd pumping plant would contain three 850 hp horizontal pumps with a rated capacity of 80 mgd each, with one on standby. The pumps would be housed in a two-story structure 26 feet high by 76 feet x 33 feet constructed partially below-grade.

The pumping plant would convey San Pablo Reservoir water using the SRW Aqueduct as both an intake and discharge line by incorporating a 72-inch isolation butterfly valve. Discharge from the plant would enter the new reservoir via the aqueduct, through 4,000 feet of 72-inch steel pipeline and 5,000 feet of 78-inch tunnel. The tunnel would extend from the I/O tower southwest through Sobrante Ridge surfacing at Castro Ranch Road, from where the steel pipeline would extend to the SRW Aqueduct along Orinda Road. The 1.7-mile long Castro Ranch Road alignment, shortest of three alternatives considered, utilizes a significantly shorter tunnel length which substantially reduces costs.

Use of the SRW Aqueduct as a pump discharge line would subject the Sobrante Filter Plant to abnormally high operating pressures unless a pressure reducing valve were also installed. Under normal non-pumping operations at the filter plant, a bypass valve would be required to permit continued flow to the plant. Both the pressure reducing valve and the bypass valve would be located at the existing Sobrante Filter Plant site in a small structure separate from the main plant.

The only new property requirements for the Pinole system would involve approximately five acres of additional right-of-way for the proposed tunnel and pipeline, as both the reservoir and the pumping plant are to be sited on District property.

The relocation of four Pacific Gas and Electric transmission towers would be required as well as relocation of Castro Ranch and Pinole Valley roads (about five miles in total length), and several miles of fire trails. No pipelines or underground utilities are known to exist within the proposed inundation area. A District surface storage tank and adjacent building exist on site as does a leased ranch house and out buildings.

5.1.4 PINOLE SITE CONSTRUCTION

Construction of High Pinole Reservoir would require an estimated 24 to 36 months to complete inclusive of site preparation activities. Actual construction of the main dam, spillway and appurtenant works (i.e., pump station, tunnel, and pipelines) would take approximately one and one-half years. An initial 9- to 12-month site preparation phase would include access road improvements, clearing, borrow site and staging area developments, and mobilization of equipment. Excavation and processing borrow material would follow site preparation activities and be carried out simultaneously with dam construction. Tunnel and pipeline construction would also occur during the second phase of work. Completion of the spillway and pump station facilities would conclude major construction activities.

An estimated 3 million cubic yards of earth, comprising the core of the main dam, would be obtained from the foundation excavation and from one or more borrow sites located upstream of the structure. Cement, processed aggregate and other construction materials would be conveyed to the site by heavy payload (10-15 CY) trucks. Highway truck traffic is anticipated to reach 15-20 vehicle trips per day during the construction period of the project. Constructing traffic would be limited to daylight hours only, but occur throughout the year with the exception of weekends and holidays.

A construction staging area would be developed on a two-acre site located in the vicinity of Castro Road near the dam site. The area would incorporate a concrete batch plant, material stockpiles, equipment storage and repair yard, office and vehicle parking.

Material excavation at the dam and at upstream borrow sites would be performed by heavy construction equipment that could include powers shovels, bulldozers, scrapers and cranes. Blasting may be required. The quantities of most equipment would be somewhat

less than presented in Table 5-1 for the Buckhorn project. On-site haul route from the primary borrow site to the construction areas would be developed within the confines of the reservoir.

Construction of the proposed dam and appurtenant reservoir structures is estimated to require a force of approximately 225 workers over a two- to three-year period. For a considerable portion of the project, the workforce might operate on a three-shift basis although construction activities are not envisioned to occur during weekends or holidays.

The estimated cost for construction of the reservoir project is approximately $60 million inclusive of supplies, labor, land acquisition and engineering design based on current prices.

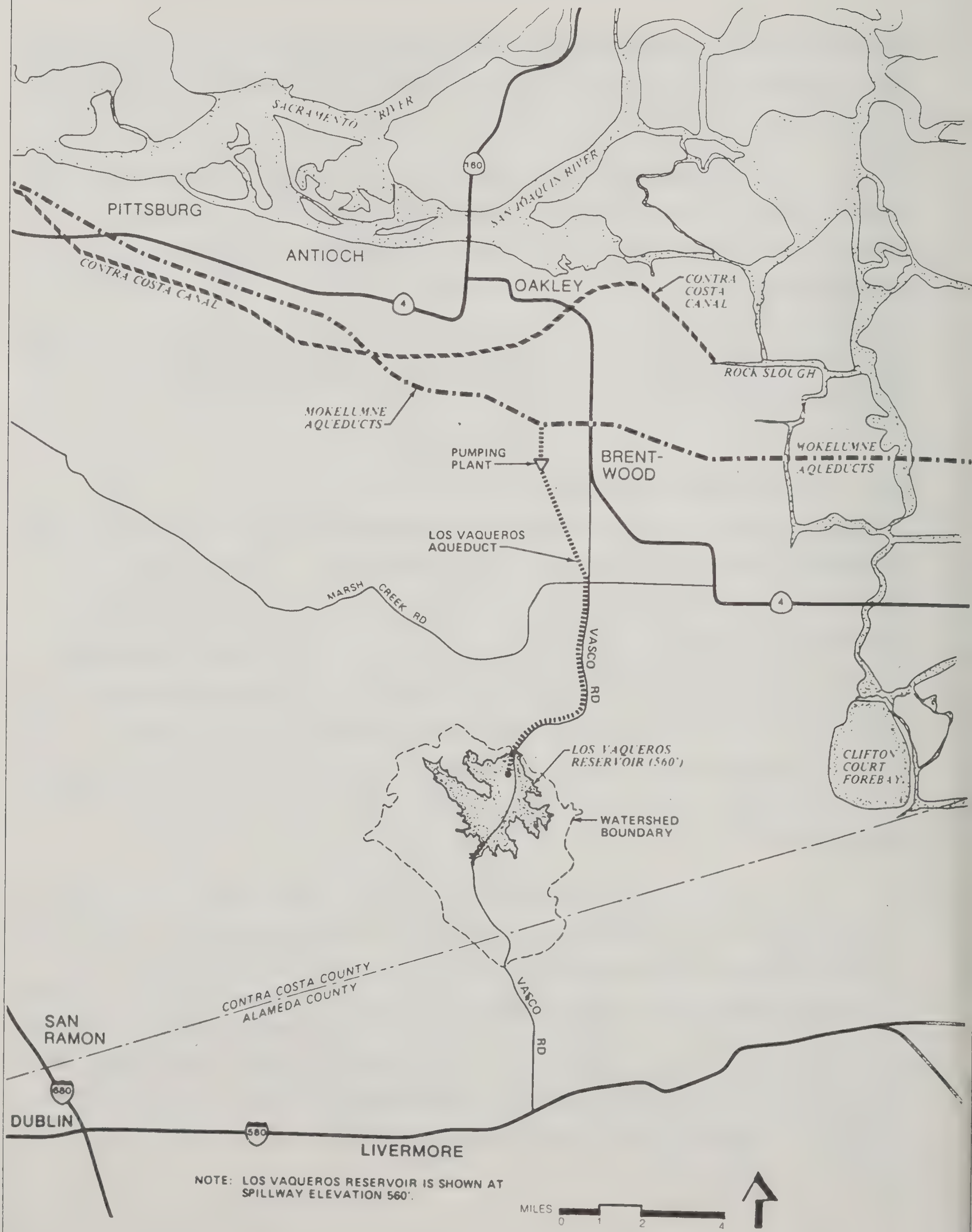
5.1.5 LOS VAQUEROS FACILITIES

The Los Vaqueros site, shown in Figure 5-3, is located on the western side of the Delta approximately nine miles south of the City of Brentwood. The reservoir would store water from the Mokelumne Aqueducts via a connection near Brentwood. This site has been evaluated by the State of California for the State Water Project and by the Federal government for the Central Valley Project, respectively. Contra Costa Water District is in the process of acquiring the property and developing a specific reservoir project for use in its system and is interested in a joint project with EBMUD and other agencies. The draft environmental impact report on Stage 1 of the Los Vaqueros/Kellogg project was completed in May 1986. The size of the proposed reservoir could range from 50,000 to 1,000,000 acre-feet.

To be consistent with the District's objective to serve the highest quality water available and compatible with existing treatment facilities, a joint project with CCWD would require storage of Sierra water in Los Vaqueros. Delta water quality particularly temperature, turbidity and algal activity, is subject to significant fluctuations. During periods of low runoff, Delta water quality can fluctuate depending upon inflows, exports and outflow to San Francisco Bay. CCWD has experienced problems with its Delta water supply in the form of high chloride levels. CCWD presently purchases surplus Mokelumne water from EBMUD on an interruptible basis in an effort to improve their water quality supply.

LOS VAQUEROS RESERVOIR SITE PLAN

FIGURE 5-3



A joint project with CCWD would involve a reservoir that provided a minimum of 144,000 acre-feet of usable storage for EBMUD. As shown in the following table, the total reservoir size would have to be approximately 265,000 acre-feet to meet joint needs. It is estimated that approximately 13,000 acre-feet would be unusable storage.

LOS VAQUEROS STORAGE
(thousand acre-feet)

Purpose	CCWD	EMBUD	Total
Usable Storage	100	144	244
Flood Control	4	4	8
Storage	6	7	13
TOTAL	110	155	265

A reservoir with 265,000 acre-feet of storage would have an approximate spillway elevation of 560 feet. At this elevation only one main embankment, about 270 feet high, would be necessary for the creation of the reservoir. Only when reservoir storage exceeds 400,000 acre-feet are additional saddle dams required.

Los Vaqueros Reservoir would be filled with water from the Mokelumne Aqueducts. A pipeline would start at the Mokelumne Aqueducts at a point near Oakley and continue in southerly direction to the reservoir. The pipeline would be approximately 7.5 miles in length. A pumping plant would be located south of the Mokelumne Aqueducts for pumping water to the reservoir. The pipeline would also connect with the CCWD's Contra Costa Canal which is approximately 2.5 miles north of the Mokelumne Aqueducts. The tie-in point on the Contra Costa Canal would be just upstream of CCWD's Pumping Plant No. 4.

EBMUD would operate its portion of Los Vaqueros Reservoir in a similar way to its other terminal reservoirs. When excess supply from the Mokelumne Aqueduct was available, water would be pumped to the reservoir. CCWD would have to purchase its supply of water from EBMUD or obtain another source of water of equivalent quality.

Considerable geotechnical work has been done on potential dam sites for Los Vaqueros Reservoir. These include studies by the DWR, the USBR, and other private consultants for CCWD. The most recent study was performed in 1987 and utilized the previous studies along with further field investigations. The study identified four potential dam sites along Kellogg Creek and determined which was most feasible. The proposed location of the dam would minimize construction cost.

Several alignments for the pipeline to the reservoir were recommended in CCWD's January 1988 Progress Report. The alignment shown in Figure 5-3 is a schematic of an alignment which would best serve EBMUD. This same alignment and pipeline could also serve CCWD. It is essentially the shortest route between the Mokelumne Aqueducts, CCWD's canal, and the proposed Los Vaqueros Reservoir. The actual alignment would not follow this direct north-south alignment but follow natural topography and utility easements to minimize construction costs.

The Los Vaqueros Reservoir would meet all three EBMUD water supply management program objectives although it is outside the District's service area. EBMUD's portion of Los Vaqueros would cost approximately $185 million in 1988 dollars.

5.2 LAND USE

5.2.1 SETTING

BUCKHORN SITE

The proposed reservoir site is located between San Leandro and Moraga on an eastern arm of Upper San Leandro Reservoir (Figure 5-4). The site consists of rolling hills and scattered trees. Kaiser and Buckhorn Creeks drain a small rocky ridge catchment and empty into the Upper San Leandro Reservoir. The site is rather inaccessible but can be reached via Callahan, Kaiser Creek and Brown Ranch roads (i.e., District fire trails). Approximately 26 PG&E high voltage transmission towers and several miles of additional fire trails are located within the proposed inundation zone. The site contains only one building which is in a dilapidated state and of no known historical significance.

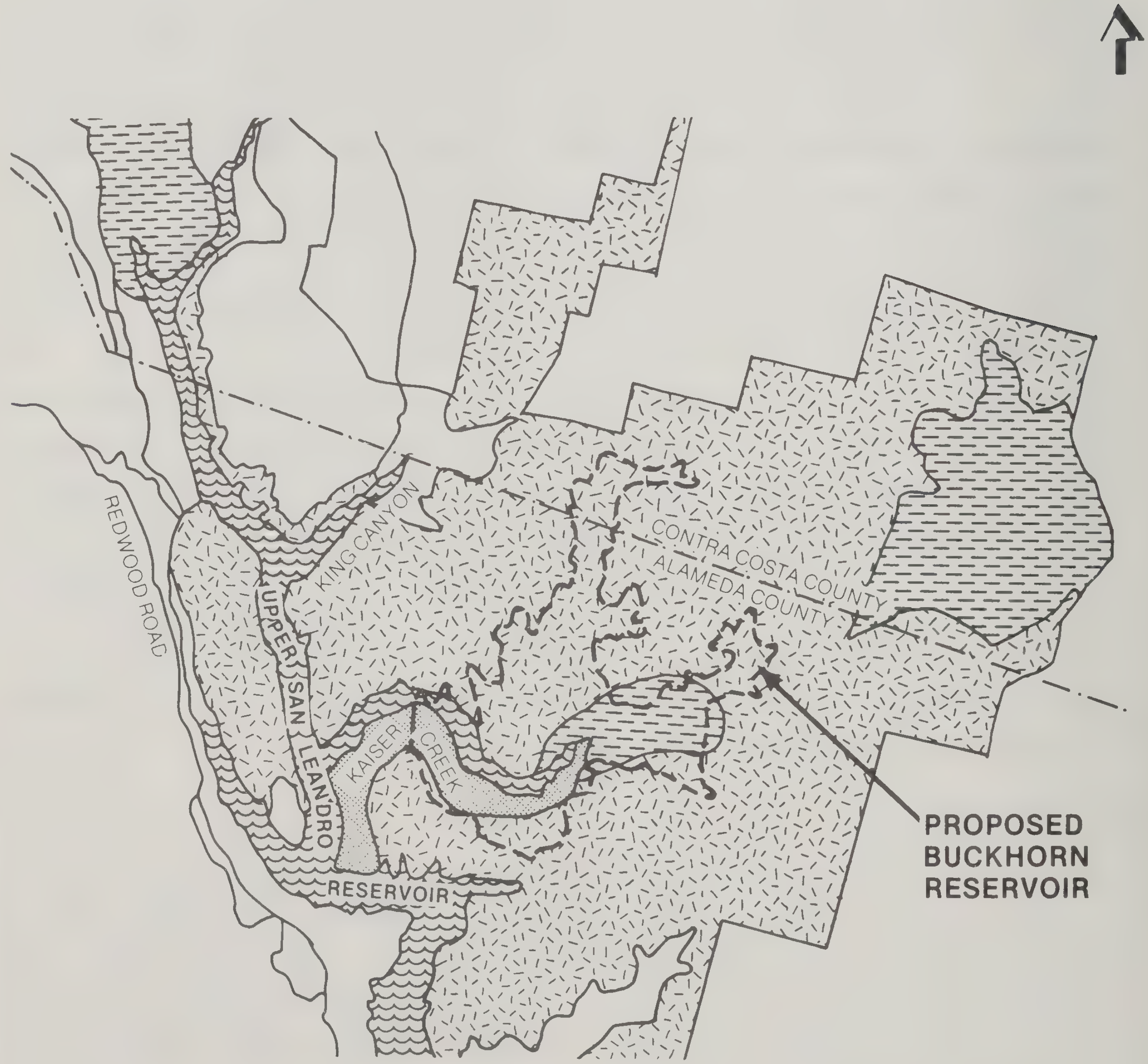
The construction of a pipeline to convey water from the proposed Buckhorn Reservoir to a pump station within the town of Moraga would create short-term impacts on surrounding land uses. Pipeline construction would occur within public road easements and right-of-ways over a distance of 4.4 miles. From EBMUD's proposed terminal reservoir the route would enter the Camino Pablo Road right of way at Rancho Laguna Park, following Camino Pablo to Canyon Road. The route would then turn north on Canyon Road and northeast on St. Mary's Road where the pipeline would tie into a new pump station. The pump station would be constructed on vacant land located adjacent to St. Mary's College, near the intersection of St. Mary's Road and Rheem Boulevard.

Surrounding Land Use

Property in the vicinity of the proposed reservoir site is primarily undeveloped land under District ownership. Land is leased to private parties for ranching, cattle grazing, and tree planting activities. To the west are Chabot and Redwood Parks and to the east is Las Trampas Park. Specific land uses in the vicinity include undeveloped/primitive recreational sites, and educational use areas such as nature study, environmental education, and natural reserves areas.

LAND USE
BUCKHORN RESERVOIR AREA

FIGURE 5-4



Ranching Areas

Undeveloped or Primitive

Educational Use Area

Proposed Buckhorn Reservoir

Recreation

No public facilities exist within the site. Hiking and horseback riding are allowed on back country trails for those who obtain trail use permits from the District. Public access is not allowed to the adjacent Upper San Leandro Reservoir (LUMP '85).

Plans and Policies

The proposed site lies within the Alameda County Castro Valley Planning Area. The Castro Valley Plan (CVP-85) designates the project site and its surroundings as an "A" District, prescribing agricultural and other non-urban uses. Major agricultural permitted uses include public and private riding, hiking, breeding and training of horses and cattle grazing.

The District's Land Use Master Plan designates the site as "Watershed Management Reserve." These are areas not used for recreational or educational purposes at the present but that are open to public by permit. The EBMUD plan does designate a portion of the site as a "nature study area," an area which allows small groups and classes for limited day-use (LUMP '85).

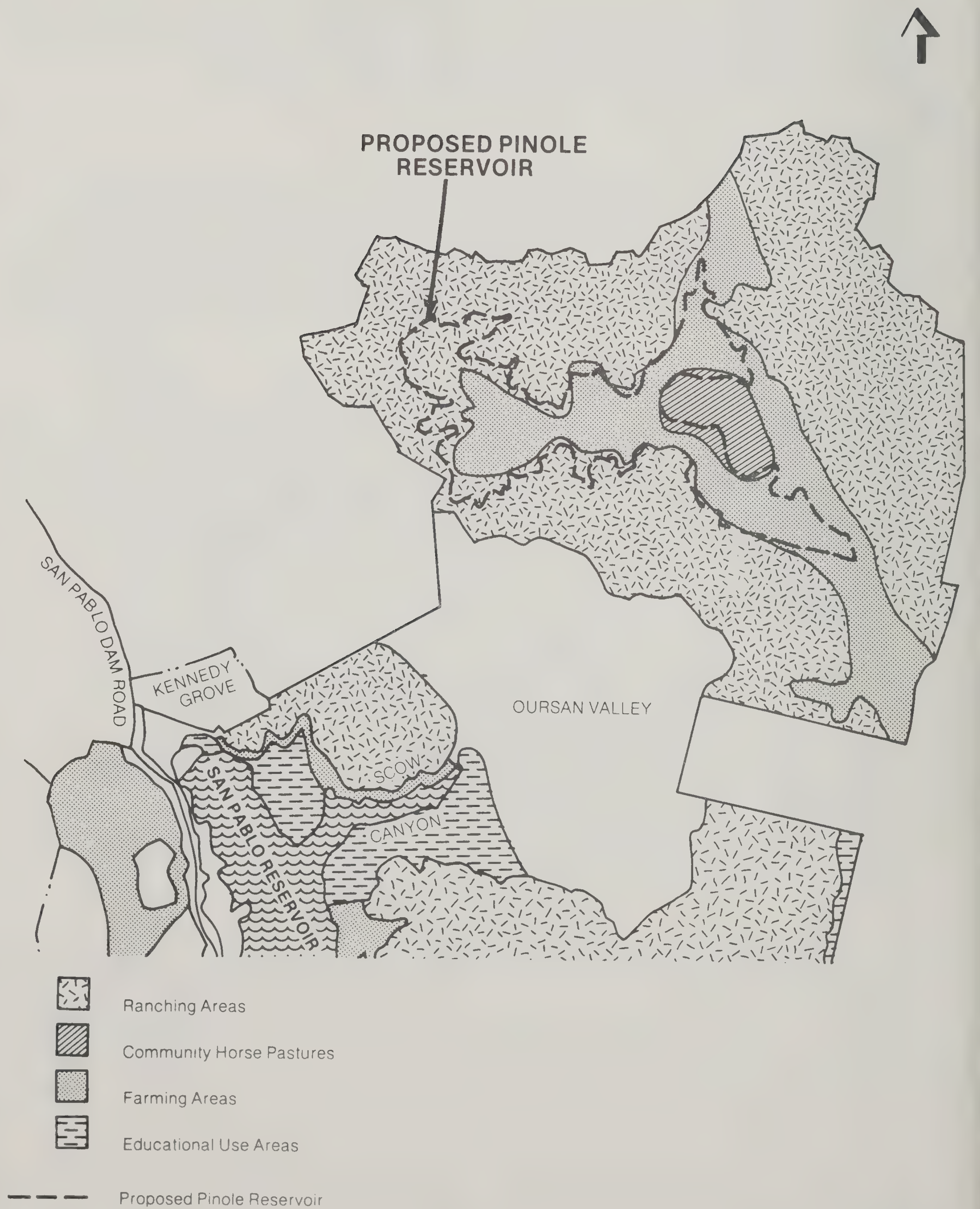
PINOLE SITE

The proposed reservoir is located on Pinole Creek between Pinole and Sobrante Ridges, northeast of San Pablo Reservoir and southeast of the City of Pinole (Figure 5-5). The site is accessible via either Pinole Valley Road or Castro Road. There is a complex of structures on-site including several cattle and horsesheds, a stable, and ranch house. The site is located within a valley surrounded by gently rolling terrain that supports a few scattered trees. The hillsides are currently used as rangeland; the valley floor is used for farming and horse breeding. There are no structures of historical interest on-site.

The construction of a pipeline to convey water from the proposed Pinole Reservoir to the existing Sobrante Aqueduct would create a short-term impacts for surrounding land uses. Pipeline construction would occur within public road easements and right-of-ways over a distance of 0.9 mile. From EBMUD's proposed terminal reservoir the proposed route would enter the Castro Road right of way.

LAND USE
UPPER PINOLE VALLEY AREA

FIGURE 5-5



Surrounding Land Use

The surrounding land is undeveloped and owned by the District. The land, in general, has physical characteristics similar to the project site. The lands are leased to private parties for cattle grazing. To the south are clusters of residential development physically separated from the site by Sobrante Ridge. The project site is not visible from existing developments.

Recreation

Recreation activities do not take place within the project site. However, land in the vicinity of the site accommodates such activities as horseback riding and hiking that are allowed if permits are obtained from the District.

Plans and Policies

The project site falls within the Contra Costa County Planning Area. The County Zoning Ordinance designates the site as an "A" District, which prescribes agricultural and low density residential use. The County Open Space Plan designates the site as "Major Open Space Area" that includes those lands used for agriculture and residential farming, state and regional parks, watershed management, open water, and tidelands for preservation of fisheries and wildlife.

The District's Land Use Master Plan (LUMP '85) designates the site as "Watershed Management Preserve" with ranching and farming areas to protect its open space characteristics. Other allowable uses in this category include community pastures and equestrian centers. Rural studies sites can also be authorized under this plan.

LOS VAQUEROS SITE

Los Vaqueros Reservoir would be located in southeastern Contra Costa County. Urban areas surrounding the project area that support local agricultural and recreational activities include Antioch, Brentwood, Byron, Pittsburg, Martinez, Livermore, Concord, Walnut Creek, and Stockton.

Surrounding Land Use

Land uses in the watershed consist mainly of agricultural (primarily cattle grazing) and open space. There are also some windfarm operations in the southeast area. Non-irrigated range and pasturelands are the agricultural uses for large portions of the watershed with fairly steep slopes and rugged terrain. Residential uses include scattered ranch and caretaker units throughout the area and more intensive residential use in the western portion of the Los Vaqueros watershed area, where larger, expensive homes are found along Morgan Territory Road.

The project has agricultural zoning designations. The estimated population within the entire watershed is approximately 100.

Recreation. Within approximately 15 miles of the proposed project area, there are at least six existing major recreation areas that include:

- Morgan Territory Regional Preserve (EBRPD)
- Del Valle Regional Park (EBRPD)
- Contra Loma Regional Park (EBRPD)
- Black Diamond Mines Regional Park (EBRPD)
- Mt. Diablo State Park (CDPR)
- The Delta (State recreation areas)

EBRPD has jurisdiction in Contra Costa County and Alameda County (except for a portion of Livermore) and operates at the regional park level in a manner similar to a county park district.

Two areas in Contra Costa County have also been designated by EBRPD as potential regional park lands. Both areas have indefinite boundaries at present but are known as Round Valley and Byron Hills. Both are within several miles of the proposed Los Vaqueros Project.

5.2.2 POTENTIAL IMPACTS

BUCKHORN PROJECT

The proposed project would result in the conversion of approximately 1,200 acres of land surface that is currently used for ranching and cattle grazing. The project involves construction of a dam, spillway, dikes, cofferdams, I/O towers, pumping plant, tunnels, access roads and pipelines. Development of the reservoir would require purchase of approximately 72 acres of additional land located at the northern end of the site presently owned by Carr Ranch. In addition, to accommodate the Buckhorn pumping plant, the District would have to acquire about 1.5 acres of undeveloped land currently owned by St. Mary's College in the Town of Moraga.

Construction

The construction phase of the dam and related facilities would cause some land use impacts. Construction is expected to occur at various intensities over several years. Major activities would include the construction of the dam, tunnel, pump station and installation of pipelines. These activities would involve large earth moving operations which would create undesirable but short term environmental impacts associated with noise, air quality, biology, and water resources which are discussed in the following sections of this chapter.

Development of the project would also require upgrading several miles of access road to the site. For the most part, the improved road would be built along existing fire trails. In addition, several more miles of on-site fire trails and 26 PG&E high voltage transmission towers would have to be relocated.

A construction staging area would be developed on a 3-acre site at the terminus of Miller Creek Road and the new access road entrance. The site would accommodate vehicle parking, an office, repair yard, material and equipment storage facility and a concrete batch plant. A new pump station would be constructed in Moraga on a 1.5 acre site adjacent to St. Mary's College connecting to the Reservoir (via King Canyon) through installation of a 4.35 miles of 84-inch diameter pipeline (Figure 5-6a).

SITE PHOTOS- BUCKHORN AQUEDUCT

FIGURE 5-6

a. Proposed pump station location. The site adjacent to St. Mary's college on St. Mary's Boulevard.

b. Construction along Camino Pablo Road may impede access to residential neighborhoods, shopping areas, schools and churches.

The proposed 84-inch diameter pipeline would be built in sections by crews of workers over the course of 10 months. More than one crew might be working simultaneously along the route. A typical construction section would extend from one block to another, while the width of the construction corridor would range from about 12 ft., at the most narrow section, to approximately 25 ft., where street widths would allow. Construction would be phased so that any particular section of the pipeline route would be impacted for a limited amount of time.

Schools, churches, libraries, residential neighborhoods, commercial areas and a recreational trail are examples of land uses which would be impacted by the proposed project. Of these, schools and libraries are considered to be "sensitive receptors," or those uses which would be most sensitive to noise and dust resulting from construction activity. Construction within the existing road corridor would interrupt or delay traffic and impede access to residential neighborhoods, community shopping areas, schools and churches along the route (Figure 5-6b). In addition, noise and dust generated during excavation and installation of the pipeline would impact the surrounding area, especially sensitive receptors located along the surrounding area, especially sensitive receptors located along the proposed route. Following is a list of the more sensitive receptors located within 1,000 ft. of the proposed route.

<u>St. Mary's College</u> (St. Mary's Road)

This private college has an enrollment of approximately 2,700 students; regular sessions run from September through May. A summer session is offered for specific programs only, and enrollment is considerably smaller. The campus' main access is from Entrance Road, via St. Mary's Road. Impacts to this facility would be related to disruption of traffic flow and access to the campus. Noise and dust related impacts would be relatively insignificant because the campus is set well back from the road.

<u>Moraga Library</u> (1500 St. Mary's Road)

The Moraga Public Library is open six days each week (Figure 5-7a). On Mondays and Wednesdays, the library is open from 10 a.m. to 6 p.m.; Tuesday and Thursday hours are from Noon to 8 p.m.; Friday and Saturday afternoons the library operates from 8 p.m. to 5 p.m. The Library's off-street parking lot is accessible only from St. Mary's Road.

Pablo Road, has a large parking lot which is accessed from the east side of Canyon Road. Access to this parking lot may be cut off for a limited time during construction; in addition, noise and dust may impact the church.

A Lutheran Church, located above Canyon Road may be subject to noise impacts generated by project construction. The church would not be impacted by dust, nor would traffic impacts result due to proximity of the church to the route.

The existing Lafayette/Moraga Trail which is part of the Contra Costa recreational trail system, parallels St. Mary's Road. This trail is heavily used by walkers, joggers and bicyclists. Two trial staging areas are located along St. Mary's Road; one, across from St. Mary's College provides parking, picnic tables provides parking and trial access. Both staging areas, and the restricted access during project construction.

Operation

Upon completion, the reservoir would have a maximum water surface area of 1,124 acres. Development of the project site will obviously preclude present use for cattle grazing. Nature study activities as outlined by the District Land Use Management Plan and the Castro Valley Plan would also be compromised. Other recreational activities such as horseback riding and hiking would be permitted on nearby back country trails. The impact on recreation due to reservoir operation is not considered significant.

PINOLE PROJECT

Construction

The proposed project would result in conversion of about 860 acres of land that is currently used for cattle grazing, community horse pastures and farming area to reservoir water surface. The project would include the construction of a dam, spillway, over five miles of access roads, and about two miles of tunnel and pipeline. These activities would involve large earth moving operations, which would create short term environmental impacts associated with noise, air quality, biology and water resources which are discussed in the ensuing sections of this chapter.

All riparian vegetation within the inundation zone would be removed. All existing structures (i.e., ranch house, cattle and horse sheds) would also be razed and removed.

The proposed project would result in relocation of four PG&E transmission towers, several miles of fire trails, and about five miles of roadway. The construction staging area would be developed on a two-acre site adjacent to the dam site and the proposed access road. Since the construction phase would last for a short period, its impacts are expected to be insignificant.

The 72-inch diameter pipeline would be built in sections by crews of workers over the course of several months. More than one crew might be working simultaneously along the route. A typical construction section would extend for 400 to 700 ft. while the width of the construction corridor would range from about 12 ft., at the most narrow section, to approximately 25 ft., where permissible. Construction would be phased so that a particular section of the pipeline route would be impacted for a limited amount of time.

Private single family residences would be impacted by the proposed project. No "sensitive receptors" such as school, libraries or hospitals are located along the proposed route. Sensitive receptors are those land uses which would be most susceptible to noise and dust resulting from construction activity.

Construction within the existing road corridor may interrupt or delay traffic and impede access to residences. In addition, noise and dust generated during excavation and installation of the pipeline may impact the surrounding area.

Operation

Upon completion, the reservoir site would cover a maximum surface area of about 860 acres. Existing on-site uses (cattle grazing, community horse pastures and farming) would be discontinued permanently. The project would generate some new land use activities including an office and maintenance and storage facilities for operation of the dam.

As the project site would conform with the plans and policies of Contra Costa County and District Land Use Master Plans the impacts on surrounding land use are not considered significant.

LOS VAQUEROS

Acquisition and Construction

Public acquisition of private property represents a significant adverse impact for affected landowners, which would only be partially mitigated by leasing and relocation measures.

Prior to construction, any occupants of land within the proposed inundation area would be displaced.

Vasco Road would require realignment. Right-of-way acquisition would be required which could result in some adverse land use impacts, particularly during construction. Access may be cut off to certain areas for a time. To mitigate this, a new road would be completed prior to the closure of Vasco Road.

An estimated seven dwelling units and approximately 21 persons would be displaced, assuming that residents both inside and outside of the reservoir inundation area would be required to relocate. This would represent a significant impact incapable of mitigation to a less-than-significant level for persons not wishing to relocate regardless of compensation.

Recreation and Operation

As specific recreation projects were not proposed, it was not possible to evaluate the degree or types of impacts that might occur. Recreation facilities can have adverse impacts on public services and can encourage local growth. Recreation areas can also conflict with plant life, wildlife, and the preservation and protection of archaeological sites.

5.2.3 SUGGESTED MITIGATION MEASURES

The suggested mitigation measures regarding land use impacts pertain to any one or all three of the candidate reservoir sites. More specific measures would be defined once the final choice is made.

To mitigate for disruption of land uses in the watershed, adoption of a long-term management option of leasing as much of the watershed (outside the reservoir inundation area) as possible was recommended. After adopting a land use management strategy, a detailed compensation and relocation plan would be developed providing full disclosure to all affected parties.

EBMUD would acquire land at fair market value. Although recreational trail use might be disrupted during construction, use of the area surrounding a proposed site would remain consistent with both county and EBMUD plans and policies.

Construction

While impacts resulting from construction are recognized to be short-term or temporary in nature, mitigations are still necessary to diminish or eliminate the impact on adjacent and surrounding land uses. The following measures are suggested as a means of limiting or minimizing construction related impacts.

Cattle grazing activities on the project site and surrounding lands should be given adequate time to relocate before construction begins. Construction-related impacts on land use can be lessened by project mitigation measures that include:

- Revegetate graded slopes;
- Landscape new roadways and project facilities to avoid flooding and landslides;
- Implement dust control measures;
- Limit certain noise generating activities, such as blasting, to daylight hours.
- Limit the width of the construction corridor to allow at least one functional traffic lane at all times during construction. Provide traffic lane at all times during construction. Provide traffic control to insure safety and an orderly flow of traffic along affected routes.
- Provide notice of construction to land uses along the pipeline route a minimum of two weeks prior to construction of a particular segment. Post informational signs and notify local newspapers to alert local businesses and residents prior to the commencement of construction.
- Establish a construction schedule which limits noise impacts to "sensitive receptors" such as schools, hospitals, and public buildings. Coordinate construction schedules

with the affected sensitive receptor; consider limiting noise producing activities during regular session hours. Where possible, schedule construction activity near sensitive receptors during school vacation periods.

- Evaluate the option of jacking the proposed pipeline under primary intersections to minimize traffic impacts in heavily traveled corridors.

- Restore to pre-construction condition, parking areas, driveways and landscaping that are disturbed by pipeline construction.

- Excavate only that length of the route which can be backfilled or covered at the end of each construction work day.

5.3 HYDROLOGY AND WATER QUALITY

5.3.1 SETTING

BUCKHORN AND PINOLE SITES

Both of the proposed reservoirs, Buckhorn and Pinole, are situated in the hills east of the San Francisco Bay. Both reservoir sites are fed by perennial rivulets, the Buckhorn site being fed by Buckhorn and Kaiser Creeks, and the Pinole site being fed by Pinole Creek. No information is available on present flow in the creeks.

Both reservoirs would be filled by waters transported from the Mokelumne River, diverted at Pardee Reservoir. This raw water is of excellent quality, as it is not subject to agricultural or municipal or industrial discharges. Minerals and turbidity are very low, synthetic organic chemicals are not detected, and tastes and odors are generally not present.

The local watersheds would contribute only a small portion of the total amount of water in the reservoirs. Therefore, water quality in either of the proposed reservoirs would be primarily influenced by imported waters that, as mentioned above, are of excellent quality.

LOS VAQUEROS

The Department of Water Resources prepared an extensive report on the Los Vaqueros site in the early 1980s. The following information has been extracted from the report.

Hydrology

The extent of the groundwater basin in the Kellogg Creek watershed is not well defined. DWR (1982) studies indicate that aquifers exist in the alluvium of the valley floor recharged by percolation from Kellogg Creek. Groundwater also exists in the sandstone, shale, and other materials underlying the alluvial formations although hydraulic continuity between these zones is not well understood. Depth to groundwater in the valleys can vary from near the surface to more than 20 feet depending on season and precipitation patterns. The alluvium is mostly clays, which have low transmissivities, and water well production is low. The shales underlying the clay are practically nonwater-bearing, although the thin sandstone layers within the shale probably contain some water.

The proposed project area is drained by Kellogg Creek and tributaries to Brushy Creek. Kellogg Creek flows north and east out of the highlands and turns eastward where it is diverted into an irrigation canal. Groundwater movement is generally to the northeast.

Sources of flow in Kellogg Creek and its tributaries include both natural springs and rainfall. Much of this water is captured in small reservoirs for use in stock watering ponds during summer months. All of the streams in the watershed, including Kellogg Creek, are identified as intermittent streams. These streams, like most interior Coast Ranges streams, have much higher flows in winter and spring, particularly after heavy rains, and low to no flows during summer.

DWR determined that the average annual flow of Kellogg Creek at the proposed Los Vaqueros dam site is approximately 2,000 af/yr. Total average annual flow at the gaging station was determined to be about 2,800 af/yr.

FCCD has analyzed flood hydrology of the watershed to determine probable peak flood flows and flood volumes near the intersection of Vasco Road and Camino Diablo Road. Peak flows for a 3-hour 100-year storm are estimated at 4,880 cfs, while the 12-hour flow volume for a 100-year storm is estimated at 2,150 af.

Groundwater quality is generally poor. Nitrate ion concentrations were found to be as high as 273 mg/l, many times the level considered safe for human consumption. The groundwater is generally hard with many area wells having hardness values of greater than 200 mg/l as calcium carbonate. In addition, much of the groundwater has boron concentrations much higher than 1.0 mg/l, which exceeds the levels identified as causing problems in crops.

During investigation of a Los Vaqueros Reservoir, DWR also conducted extensive sampling of Kellogg Creek. The information compiled by DWR was presented in its "wrap-up report" for the Los Vaqueros Reservoir project. Generally, low quality water samples were associated with lower flows in Kellogg Creek. Flows in Kellogg Creek result largely from precipitation within the watershed, although there are several natural springs in the

project area. Trace element levels are rather low, but mineral constituents can be quite high in Kellogg Creek. The quality of Kellogg Creek is such that it is largely unusable for irrigation or domestic purposes. In addition, substantial flows (when the quality is the highest) occur only in the winter and spring when irrigation needs are lowest.

5.3.2 POTENTIAL IMPACTS

BUCKHORN PROJECT

Operation

There would be no immediate downstream impacts from the operation of the Buckhorn Reservoir as the Upper San Leandro Reservoir is located directly below the proposed dam site. In fact, Upper San Leandro Reservoir would inundate a portion of the downstream face of Buckhorn Dam. Conditions in the natural channels downstream of the two-reservoir complex would be determined by the releases from Upper San Leandro Reservoir. Some reduction in peak wintertime flows may occur.

Water quality in the initial years of reservoir operations could be adversely impaired if proper clearing and organic materials removal is not practiced. The immediate buildup of THMs from the decay of organics could pose a remote, but possible, water quality problem.

Construction

During an estimated four-year construction period, the potential for erosion of soils at and adjacent to the construction site would be substantially increased. These eroded soils would most likely be deposited in Upper San Leandro Reservoir. This could lead to potential lowering of water quality in the main terminal reservoir, and, under extreme circumstances, the possible degradation of aquatic and riparian habitat. Quality of treated water supplied from Upper San Leandro Reservoir could possibly suffer, or the cost of treatment could increase.

During construction activities there also exists a possibility of spillage of various types of hazardous substances, such as fuel or surface coating compounds or cleaning agents. Such events if not contained could lead to degradation of water quality in Upper San Leandro Reservoir.

PINOLE PROJECT

Operation

Implementation of the proposed Pinole Reservoir project would result in a change in the flow distribution downstream of the dam site. The creekbed currently dries up during the dry summer months, while winter flows tend to respond to storm events, with peak flows immediately following these storms. Releases from the reservoir would most likely be at a relatively uniform rate, depending on the season. All flows within the watershed would be stored in the reservoir, with the release schedule negotiated between the District and wildlife agencies. The quality of water released to the creek would be noticeably better than existing surface runoff as nearly all would constitute imported Mokelumne supply. The reduction in peak wintertime flows would alter downstream channel geometry over a number of years and reduce flooding.

Construction

Dam and access road construction activities would increase the potential of serious soil erosion during the two to three years of proposed project construction. This could lead to a degradation of water quality in Pinole Creek downstream of the dam site, potentially resulting in a degradation of aquatic and riparian habitat. The possibility of a spill of hazardous materials always exists on a construction site, which could lead to water quality degradation downstream as well as adversely affect area groundwater.

LOS VAQUEROS

Groundwater

If groundwater were used extensively during construction for concrete production, material compaction, and dust prevention, groundwater levels could decline in the project area. Groundwater levels could also decline downstream if extraction were to occur under the proposed pool area because shallow groundwater flow is believed to flow in the same general direction as Kellogg Creek, recharging downstream basins. DWR determined during its studies of Los Vaqueros Reservoir that completely cutting off the downstream flow of groundwater would probably affect downstream basins only slightly. DWR also determined that insufficient groundwater existed in the project area to provide a reliable source of construction water. Therefore, groundwater use during construction would be limited, and additional water would be brought in for construction purposes. No source or route for this supply has yet been identified.

Construction of a dam and reservoir would not substantially affect groundwater quality. Insufficient groundwater is available for construction purposes; therefore, pumping would be minimal, and water would be provided from other as yet unidentified sources. Dam construction could involve excavation, blasting, and fill activities. Alluvial materials would probably be excavated to bedrock, and it is likely that groundwater would have to be pumped from the excavation area to allow construction. This extracted water could be stored or it could be discharged to Kellogg Creek.

Operating a reservoir within the project area would probably improve groundwater quality very slightly in the area. The presence of a large reservoir may induce added recharge beneath the reservoir and might eventually increase groundwater flow to adjacent basins. The magnitude of this effect is expected to be small, based on information developed by DWR. Such groundwater flows are expected to follow the existing flow patterns, and would have little effect outside the basin.

Surface Waters

Kellogg Creek does not contain sufficient flows during most years to provide a reliable source of construction water, and would not be used for this purpose. Water for construction purposes would be brought to the site. During early construction activities, water from Kellogg Creek would most likely be bypassed around any dam site. Later in the construction process water might be bypassed, or it might be stored behind the dam foundations. The decision to either bypass or store Kellogg Creek flows would depend on a number of variables including downstream water rights, reservoir water quality, and storage needs.

Construction of a dam along Kellogg Creek could cause substantial erosion and subsequent sedimentation in the creek in the area of the dam site and downstream. Most construction activities would take place in summer and fall when stream flows are at their lowest. Due to the necessary approval of various State agencies, which should require measures to mitigate potential construction impacts, and timing considerations, this potential impact is judged less than significant.

Operation of a reservoir would not adversely affect the quality of surface water streams downstream of the project site. If downstream releases are made, the water quality would probably be improved over existing conditions. Water in the reservoir would probably be of higher quality than flows typical of the area watersheds.

Water quality of a reservoir could be affected by a number of variables including surrounding land uses, long-term watershed management activities, recreation development, soil erodibility and mineral content, and other aspects of the proposed project.

5.3.3 PROPOSED MITIGATION MEASURES

The use of appropriate construction methods will greatly reduce potential for serious soil erosion during construction activities. The specific methods and language would vary from site-to-site, but the general methods to be adhered to include the following:

- Adequate drainage to be provided to intercept and divert surface runoff away from disturbed areas.
- Runoff from excavations must not be discharged directly to Upper San Leandro Reservoir or Pinole Creek; rather, it should be treated in settling basins and then discharged.
- Rock used for cofferdam construction should be washed and clean.
- Access roads should be properly constructed to reduce erosion.
- The reservoir site should be adequately cleared of vegetation and debris before the reservoir is filled.
- Provisions for adequate spoils removal and disposal should be included in the construction contract.
- A spill prevention plan specifying how fuels and construction materials would be handled should be included in the construction contract.

5.4. GEOLOGY AND SOILS

5.4.1 SETTING

BUCKHORN SITE

Bedrock Geology

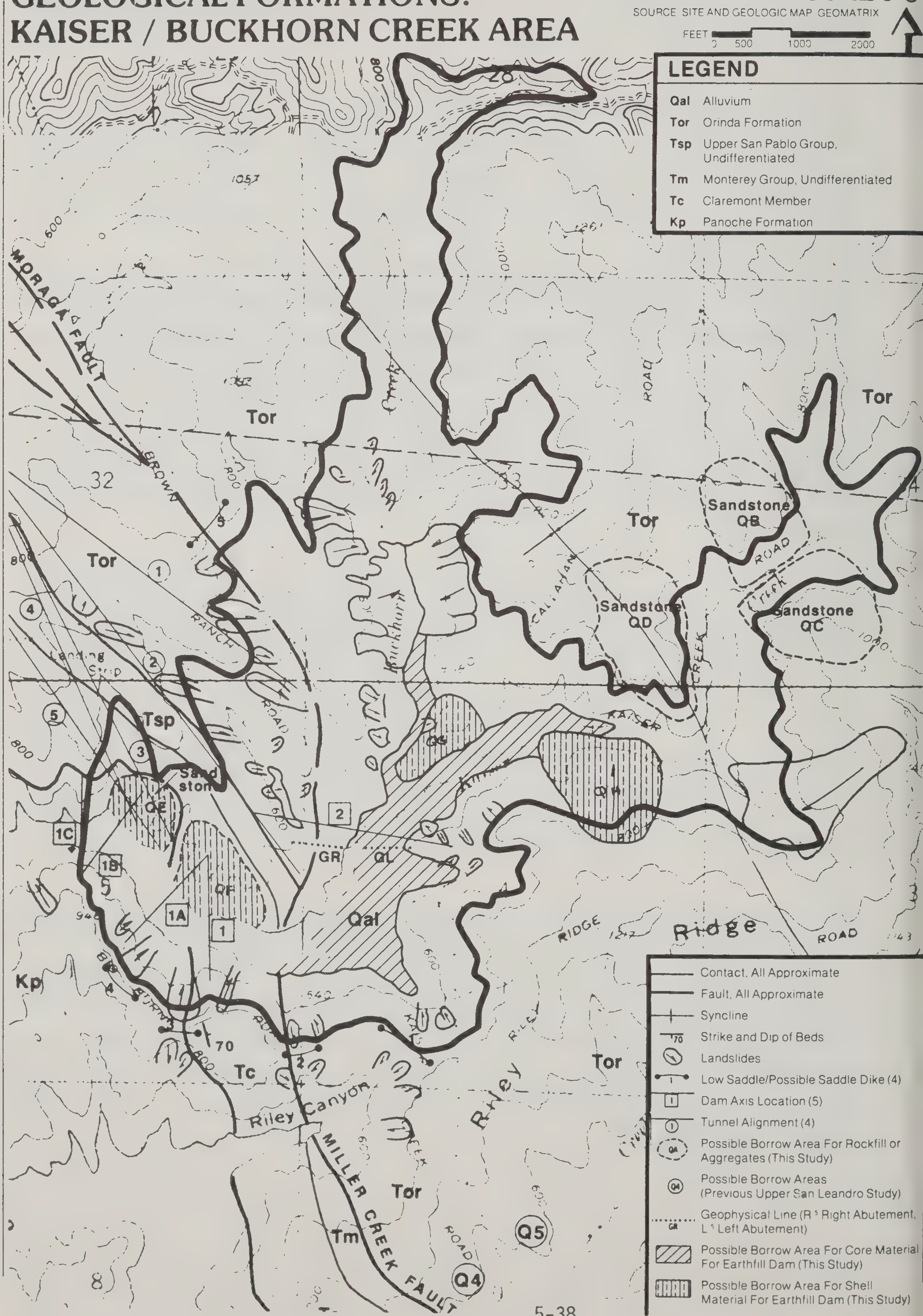
The geologic/soils effects of the proposed WSMP alternative terminal reservoir locations must be considered from two points of view: the effects of the project on the environment and the effects of the environment on the project. In the first category, the short-term impacts of dam, tunnel, spillway, pipeline and pumping station construction are considered. In the second category, the geologic hazards that could damage the structural parts of the alternative projects are considered. These hazards must be taken into account during the design of the project to avoid, reduce or eliminate the possibilities of spills and disruption of service, which, in turn, would have further environmental consequences.

The geology of coastal California is related to plate tectonics. The earth's mantle is composed of several large plates that move relative to each other. The fault systems along the west coast of the United States, including such faults as the San Andreas and the Hayward, are at the junction of two such plates. The Pacific Plate, on the west, is moving north relative to the North American Plate on the east. One of the results of this movement is the regional rock deformation that provides the general northwest-southeast trend of valleys and ridges in the Coast Ranges. Another result is the regional seismicity that is common to the entire San Francisco Bay Area. The geologic formations in the study area belong to the Coast Ranges on the western edge of the North American Plate.

Within the valley of Kaiser Creek, the floor of the study area is underlain by alluvium, the youngest geologic formation in the vicinity of the site (see Figure 5-8). Valleys in the area were filled with alluvial sediments during Quarternary time, by streams depositing sand, silt and clay. Wet, fine-textured silt and clay is exposed on the river flats and edges of Upper San Leandro Reservoir at low-water stages, reflecting on-going sedimentation within Kaiser Creek. Landslide deposits (colluvium) are locally abundant on the northern tributaries of the valley and are notably common along Buckhorn Creek just south of the Alameda County line.

GEOLOGICAL FORMATIONS: KAISER / BUCKHORN CREEK AREA

FIGURE 5-8



Several different rock formations are exposed on the east side of Upper San Leandro Reservoir. The youngest of these is the Pliocene Orinda formation. This unit contains conglomerate, sandstone, siltstone and claystone derived from non-marine sources such as volcanic rocks, ash and tuff. Organic shales and some clays and unconsolidated sandstone also occur in this formation.

Next oldest is the Miocene Upper San Pablo Group. This unit also consists of sandstone, shale and conglomerate, but they are marine in origin.

The Monterey Group consists of Miocene marine shales and sandstones that are the next oldest deposits in the area. The Claremont Member is a shale unit in the Monterey Group.

Underlying these rocks are the Upper Cretaceous marine sedimentary rocks of the Panoche Formation. This unit contains massive sandstones, siltstones, shales and conglomerate lenses. These rocks were deposited as sediments in a deep ocean trench, probably near the juncture of the two crustal plates. During that time the oceanic plate was being thrust under the continental plate, creating massive deformation of the accumulated sedimentary, metamorphic and volcanic rocks. This is indicated by the intense faulting, fracturing and shearing throughout the Coast Ranges.

<u>Soil Types</u>

The soils of Alameda County and Contra Costa County belong to two major groups which are subdivided into 26 associations containing nearly 200 different soil varieties. Of these, the proposed Buckhorn Reservoir would be in only one association containing 16 soil varieties. The major soil group is related to the substrate on which the soil varieties have developed. Soils of the high terraces, foothills, uplands and mountains generally were developed on bedrock terrains or on bedrock thinly overlain by unconsolidated material. Soil conditions affect construction conditions. Soil series comprised by this soil association are tabulated on Table 5-2. Soil services comprised by this association are tabulated on Table 5-2.

The Millsholm-Los Gatos-Los Osos Association soils (Association 3 in Alameda County and Association 12 in Contra Costa County) are well drained to excessively drained, strongly

TABLE 5-2: BUCKHORN
DAM AND ABUTMENT: SOIL SERIES

Unit	Name	Texture	Perm.	Runoff	Erosion	Shrink Swell	Comments
LpF2	Los Gatos-Los Osos	Loam Heavy Loam	Moderate to Moderately Slow	Very Rapid	Very Severe	Low	Contra Costa Co. Soil Survey describes Los Osos soils as highly expansive and highly corrosive.
LuE2	Los Osos & Millsholm	Silty Clay Loam	Moderate to Moderately Slow	Medium to Rapid	Severe	Moderate	Contra Costa Co. Soil Survey described Millsholm soils as mildly expansive.
MhF2	Millsholm	Silt Loam	Moderate	Very Rapid	Very Severe	Moderate	Contra Costa Co. Soil Survey described Millsholm soils as mildly expansive.

RESERVOIR: SOIL SERIES (INCLUDES ABOVE SOIL SERIES)

Unit	Name	Texture	Perm.	Runoff	Erosion	Shrink Swell	Comments
LeE-LeG	Los Gatos	Loam	Moderate to Slow	Very Rapid	Very Severe	Low	
LtD-LtE2	Los Osos	Silty Clay Loam	Moderate to Slow	Medium to Rapid	Medium to Rapid		
DaB	Danville	Silty Clay Loam	Slow	Slow to Medium	Slight to Moderate	Moderate	
DmF2	Diablo	Clay	Slow	Rapid to Very Rapid	Very Severe	High	
MhE2	Millsholm	Silt Loam	Moderate	Rapid	Severe	Moderate	
RoF	Rock Land	--	--	--	--	--	No soils present.
Za	Zamora	Silt Loam	Moderately Slow	Slow	Slight	Moderate to High	

Source: USDA Soil Conservation Service.

to very steeply sloping loams, silty loams and silty clay loams, used primarily as pasture and range land.

PINOLE SITE

Bedrock Geology

The valley occupied by this reservoir site is a structural trough. The sharp flexure in the rocks has folded many of the clay layers into a basin which retains the water that percolates downward from the surface. The water table in the valley is nearly constant and the sediments in the basin are in a rather soft, saturated condition. The proposed locations of the abutments for the dam at this site are covered with Colluvium. This is a residual soil derived from the underlying formations. It is clayey and sandy, containing decayed vegetation in the upper two feet, and grades downward into more compact sediments below the zone of weathering (less than five feet).

The floor of the valley is covered with Alluvium, a relatively deep deposit of soil materials washed down the river. The thickness of the alluvial deposits varies considerably with the undulations caused by the various channels cut by the stream. The alluvium consists of materials ranging in size from clay to gravel (see Figure 5-9).

The Tice Shale appears in remnants at various places adjacent to the proposed dam site, but its distribution is so uncertain that it was not plotted by the geologists who performed the reconnaissance of the site. It is a bituminous shale, generally pink to yellow in color.

Oursan Sandstone underlies most of the dam site. This formation is a white to tan, fairly well compacted, fine grained rock containing small amounts of clay shale interbeds.

The Claremont Shale underlies the Oursan Formation. It is exposed in the hillsides and forms part of the southwestern limb of the structural trough beneath the valley.

The Sobrante Sandstone lies beneath the Claremont Member. It has been fractured and broken during the folding of the rock formations in the area.

GEOLOGIC FORMATIONS: UPPER PINOLE VALLEY AREA

FIGURE 5-9

SOURCE: U.S. GEOLGICAL SURVEY

Qa	Aluvium
Tmss	Sandstone, Light Gray, Massive, Minor Interbedded Siltstone, Locally Fossiliferous (Primarily Briones Sandstone but also includes Neroly Formation and Cierbo and Hambre Sandstones)
Tmsl	Siltstone, (Mudstone), Light Gray, Massive Argillaceous to Sandy
Tmsh	Shale, Gray-white, Massive to Platy, Silty (Includes Rodeo and Tice Shales of Monterey Group)
Tmsc	Claremont Shale of Monterey Group, Brittle, Cherty, Siliceous
Tmso	Sobrante Sandstone
Tk	Kreyenhagen Formation, Claystone with thin Sandstone beds

Soil Types

The proposed Pinole Reservoir would be in two soil associations containing 15 soil varieties. The major soil groups are related to the substrate on which the soil varieties have developed. Soils on the floodplains, low terraces and alluvial fans were developed on the unconsolidated deposits of the valleys and former shores. Soils of the high terraces, foothills, uplands and mountains generally were developed on bedrock terrains or on bedrock thinly overlain by unconsolidated material. Soil series comprised by the following soil associations are tabulated in Table 5-3.

The Clear Lake-Cropley Association soils (Association 5) are nearly level to gently sloping, poorly drained to moderately well drained clays on valley fill and in coastal valley basins. They are used primarily for urban development and some dry farming.

The Los Osos-Millsholm-Los Gatos Association soils (Association 12) are well drained, moderately steep to very steeply sloping clay loams and loams, formed of material weathered from sedimentary rocks in the uplands. They are used primarily as range land and wildlife habitat.

5.4.2 SEISMICITY

BUCKHORN AND PINOLE SITES

There are two major types of hazardous geologic conditions to be considered in the study area: seismicity and slope instability. The entire Bay Area is part of the most active seismic region in the United States. Each year, minor and moderate magnitude (M) earthquakes occurring within or near this region are felt by residents of the eastern Bay Area. Most of the seismic activity is generated along the San Andreas, Hayward or Calaveras fault zones, although earthquakes epicentered on the Concord-Green Valley, Antioch and other fault zones also have affected the region (see Figure 5-10).

There are several active and potentially active fault zones that could affect terminal reservoir facilities in the study area. Active faults are those that are historically active, that is those that have shown some movement during the last 200 years, and those that have been active in the geologically recent past (during about the last 10,000 years,

TABLE 5-3: UPPER PINOLE

DAM AND ABUTMENT: SOIL SERIES

Unit	Name	Texture	Perm.	Runoff	Erosion	Embankment Shear Strength	Compress-ibility	Shrink Swell	Corros-ivity
Cc	Clear Lake	Clay	Slow	Very Slow	None	Moderate to Low	Medium	High	Very High
Cea	Conejo	Clay & Heavy Heavy Clay Loam	Moderately Slow to Slow	Slow	None	Moderate to Low	Medium	Moderate to High	Moderate to High
LhE-LhF	Los Osos	Clay Loam & Clay	Slow	Medium to Rapid	Moderate to High	Moderate to Low	Medium	High	High
MeF	Millsholm	Loam	Moderate	Rapid	High	Moderate to Low	Medium	Low	High
CkB	Cropley	Clay	Slow	Slow	Slight	Moderate to Low	Medium	High	High

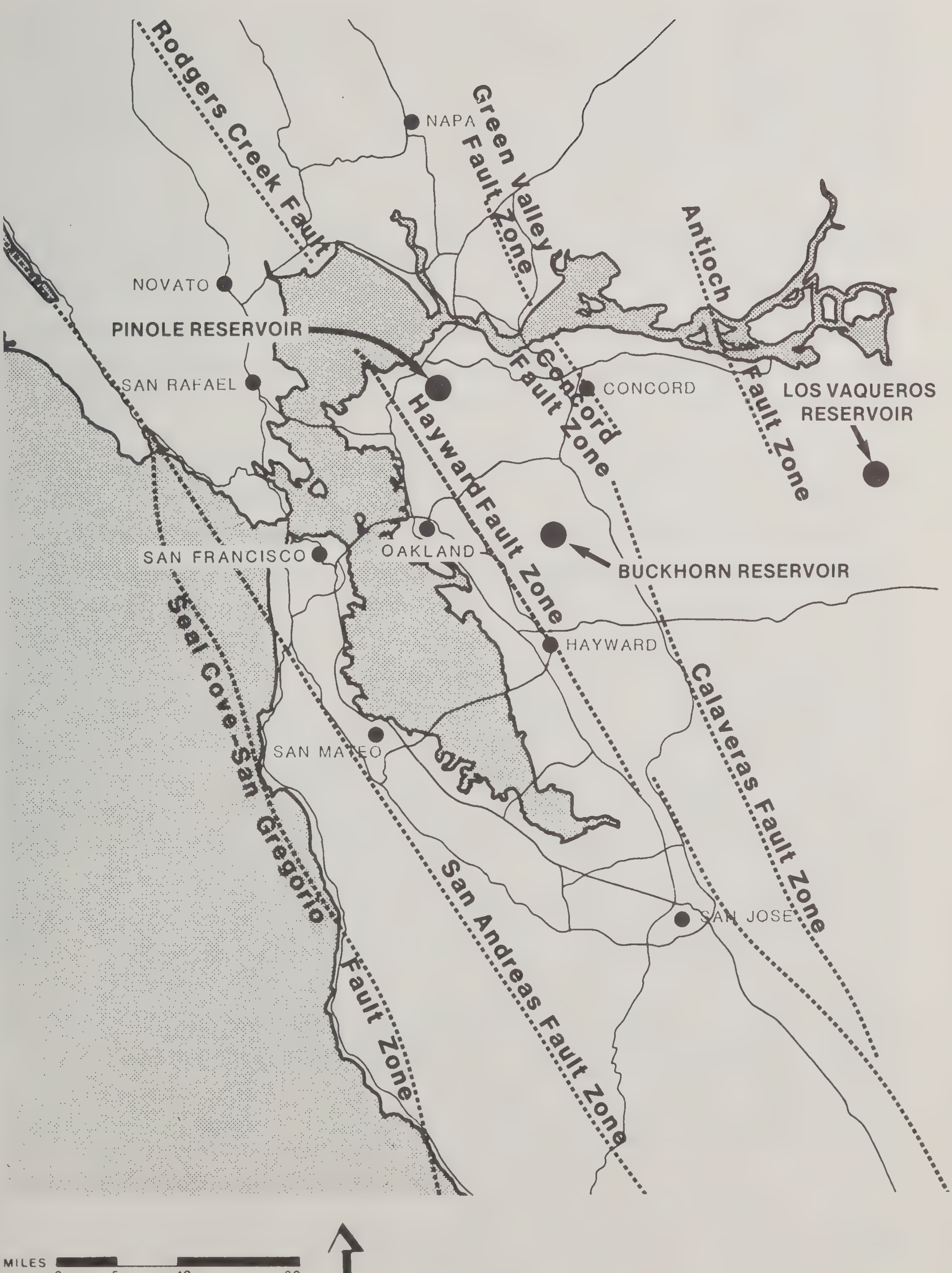
RESERVOIR (INCLUDES ABOVE SOIL SERIES)

Unit	Name	Texture	Perm.	Runoff	Erosion	Embankment Shear Strength	Compress-ibility	Shrink Swell	Corros-ivity
Cc	Clear Lake	Clay	Slow	Very Slow	None	Moderate to Low	Medium	High	Very High
CkB	Cropley	Clay	Slow	Slow	None	Moderate to Low	Medium	High	High
LhE-LhF	Los Osos	Clay Loam & Clay	Slow	Slow	Medium	Moderate to Low	Medium	High	High
MeE-MeF	Millsholm	Loam	Moderate	Rapid	High	Moderate to Low	Medium	Low	High
RbC	Rincon	Clay and Loam	Slow to Moderately Slow	Medium	Slight	Moderate to Low	Medium	Moderate to High	Moderate to High

Source: USDA Soil Conservation Service

FAULT LOCATION MAP

FIGURE 5-10



usually referred to as the Holocene period). Those that have been active at some time in the Quaternary geologic period (during the last two million years) are categorized as potentially active. Active faults have a high probability of continuing to experience seismic activity. Potentially active faults have a lower probability of experiencing continued seismic activity, but should not be considered "dead."

The Hayward, Calaveras and San Andreas fault zones all are historically active. Numerous branch faults occurring within or adjacent to the major fault zones may be active or potentially active. Parts of each of the major fault zones have been classified as potentially active because they do not display evidence of recent movement. Other faults noted in the study area include the Miller Creek, Moraga, San Leandro Creek and Pinole faults. None of these faults have been reported to be active.

Of the major active fault zones, the Hayward is capable of generating a maximum expected earthquake of M7.5; the Calaveras, an M7.5 earthquake; and the northern section of the San Andreas, an M8.3 earthquake. Earthquakes of these magnitudes are sufficient to create ground accelerations in bedrock and in unconsolidated deposits severe enough to cause major damage to structures, foundations and underground pipelines. Within the areas being considered for reservoir location, the maximum credible ground accelerating from these three faults were estimated to be in excess of 0.5 g (equivalent to one-half the acceleration of gravity) by the California Division of Mines and Geology (CDMG) in 1974. These values have been refined by Geomatrix Consultants in their 1987 reconnaissance study for the Buckhorn Dam site. The peak ground acceleration at Buckhorn is expected to be about 0.6 g for an M7.5 earthquake on the Hayward fault, about 5 miles west of the site, and 0.4 g for an M8.25 earthquake on the San Andreas fault, about 24 miles west of the site. An M7.5 earthquake on the Calaveras fault, about 7 miles east of the site, probably would have an acceleration value between 0.4 and 0.6 g, being overshadowed or "masked" by the Hayward fault, which is closer to the site. According to the Contra Costa County Seismic Safety Element (1986) ground accelerations at the pinole Dam site would be between 0.25 g and 0.5 g under similar seismic conditions because the Pinole site is about a mile closer to the Hayward fault.

The other faults that occur within the vicinity of the proposed dam sites that should be considered are the Miller Creek fault, the Moraga fault (an extension of the Miller Creek fault), the San Leandro Creek fault and the Pinole fault. All but the Pinole fault are in the vicinity of the Buckhorn Dam site. At the Buckhorn site, the faults separate rock formations of the Cretaceous and Tertiary ages. By about 1975, various studies collated by the CDMG indicated that these faults had not been active for at least two million years. Like many other mapped faults in the Bay Area, these faults are not associated with current seismic activity and do not represent an earthquake threat to construction.

Near the Pinole site, several branches of the Pinole fault were identified by B.B. Gorden, C.E., in his letter report of 1987. This fault system is described as pre-Holocene, meaning that it has shown no activity within the past 11,000 years and is considered inactive. The CDMG maps the entire system as pre-Quaternary, indicating no activity within the last 2 million years and in 1980 removed it from the list of faults that were considered potential surface rupture hazards. Microseismic activity that was detected in the area between the Briones Reservoir and the Lafayette Reservoir in 1977 had been tentatively assigned to the Pinole fault, but to date not investigations have established the occurrence of active movement along the fault.

Numerous other faults exist through-out the study area. These faults are pre-Quaternary in origin, generally being related to the Coastal thrust belt or the Coast Range thrust. They were active tens of millions of years ago, but have shown no evidence of activity during the last two million years. These faults are shown on maps produced by the CDMG and the United States Geological Survey (USGS) for the information of geologists, engineers and the general public interested in current and ancient seismicity in California. No distinction is made, on the maps, among faults more than two million years old because they have limited relevance to human planning efforts dealing with the seismic design of buildings or dams.

The hazards discussed in the following paragraphs are associated with particular topographic or soil/rock responses to <u>active</u> seismicity. They are not associated with inactive faults and do not occur in all parts of the study area or with equal frequency and intensity. It is important to recognize that regardless of which site is selected, the

structure that is proposed must meet the seismic stability standards of the State Division of Dam Safety. Without adequate seismic design, monitoring systems and emergency preparedness procedures the structure would not be permitted to be built. An earthquake preparedness plan is described in concept for on page 5-59 of this EIR.

Hazards related to seismicity include surface rupturing, groundshaking, landsliding and liquefaction. Surface rupturing along the trace of a fault affects all types of material, however, it does not always show clearly in a loose or water-saturated soil. Damage due to surface rupturing is limited to a fairly narrow zone along the trace of the fault break, unlike damage from groundshaking that can occur at great distances from the fault. Even a moderate earthquake can be accompanied by enough surface rupturing to damage structures that have not been adequately protected where they cross fault traces.

Bedrock formations and unconsolidated deposits (soils) exhibit different responses to seismically induced groundshaking. As a general rule, the severity of groundshaking increases with proximity to the epicenter of the earthquake. However, given similar location and seismic energy output, the least amount of damaging vibration would occur on a site that was completely composed of bedrock. A site underlain by major thicknesses of alluvium would experience considerable more damaging vibration because of the unconsolidated material's tendency to deform to a greater degree than the bedrock.

Earthquake-induced landsliding of steep slopes can occur in either bedrock or unconsolidated deposits. Firm bedrock usually can stand in steeper, more stable slopes than soils are able to maintain, but rock type, grain size, degree of consolidation, and angle of the beds all contribute to the strength or weakness of a bedrock hillside. Shales and deeply weathered rocks are very susceptible to slope failures.

Another response to severe groundshaking that can occur in loose soils is liquefaction. This transformation from a solid to a liquid ("quicksand") state can cause ground settling and may contribute to landsliding. Earthquake-induced liquefaction does not affect bedrock, however it does affect certain types of alluvium under conditions of saturation.

5.4.3 SLOPE INSTABILITY

BUCKHORN AND PINOLE SITES

Static slope instability is the major cause of landslides. Landslides are a significant component of the natural erosional processes in the Coast Ranges. Although existing geologic material forms the basis of instability, natural processes, such as rain saturation, and human activities, such as grading, may initiate landslides in otherwise stable areas.

Some geologic material, such as clay minerals, have a great capacity to absorb water. The result is a reduction of shear strength in rocks containing the clays. The weight of rock creates shear stresses that can cause landslides when saturated clays reduced the shear strength of the underlying rock below its minimum stability threshold. The Pliocene non-marine sedimentary rocks in the study area tend to be unstable because of the clay constituents. The sheared and fractured shale matrix of the upper Cretaceous marine sedimentary rocks also make them fairly unstable. Areas underlain by these rock types are slumping constantly in Contra Costa and Alameda Counties. Whole hillsides of this material can creep downslope in a slow-moving landslide known as an earthflow. Another unstable situation exists where the bedding planes of rock strata are parallel to the surface slope of the ground. In this case the potential exists for entire rock units to slip along a weakened plane.

Fault zones contain weakened rock, crushed by the repeated motion along the fault. Heavy rains can saturate a slope, reducing its shear strength. Stream cuts along the base of a slope can induce sliding by removing needed support from weak zones during high flood stages. Chemical and mechanical weathering can break down rock materials and the seepage from high groundwater levels can increase water concentration, thus reducing strength. The steepness of a slope is a major component of instability because of the unsupported weight of rock and soil that may bear on a weak zone. Such human activities as making road cuts, diverting surface runoff or impounding water can reduce the natural shear strength of bedrock slopes and generate landsliding even in areas of normally low susceptibility.

There are five soil conditions in the study area that could affect the project: permeability, expansiveness, erosion, liquefaction and landsliding. Expansive soils are common at

the Pinole site; erosion hazards vary between moderate and very high at the Buckhorn site. Liquefaction potential generally is low, but the variability of the soil conditions make generalization inappropriate when dealing with specific localities. Soil strength throughout the study area is poor to fair, whereas erosion potential tends to be high. Steep slopes, combined with shallow depths to bedrock, indicate that generally low stability under static conditions is fairly common. Soil creep and/or shallow landslips occur on most slopes steeper than a 15% grade.

Low permeability, or a very slow rate of percolation, would be an asset for the construction of reservoirs. High or excessive permeability would not be an asset because of the difficulty that would be encountered in sealing the reservoir walls and floor. The facilities are intended as storage locations for the water in the system and not as recharge areas. Soils with low permeability dominate the valleys of the Coast Ranges. This same low permeability can produce structural problems if water collects beneath or within the foundations of structures, such as abutments or spillways. Positive drainage must be established to prevent supporting soils from becoming weakened by saturation.

Expansiveness, or the potential to swell and shrink with repeated cycles of wetting and drying, is another feature of some of the soils in the study area. Expansiveness would not be an asset for the construction of spillway or pipeline foundations. Expansive soils are weak and compressible; they do not provide adequate support for foundations unless they are specially treated. Sometimes they must be removed entirely and replaced with engineered backfill. If left in place these weak soils can cause unacceptable amounts of settlement. The effects can range from the nuisance level to the major structural damage level. Combined with seismic loads, the effect could be sufficient to make the difference between survival and destruction of a component of the system during a major earthquake.

Erosion potential is variable throughout the study area, but generally is moderate in the fine grained, flat-lying soils, ranging to very high in the coarse-grained, steep soils. Soil erosion can be a problem for the project components in ways similar to those produced by expansive soils. Basically, the loss of foundation support can result from excessive erosion. The project could contribute to increased soil erosion in the areas of construction and thereby cause similar problems for existing slopes in the project vicinity.

Liquefaction is the transformation of a soil from a solid state to a liquid state as a response to seismically-induced groundshaking. The transformation can be very rapid. The soil characteristics of a liquefaction-prone deposit are saturated conditions, loose, uniformly fine sand, little or no clay-sized particles to act as binders and sufficiently violent vibration to increase pore pressure beyond the shear strength of the sand particles. If these conditions occur within about 30 feet of the ground surface, any structures supported on the soils would be subject to tilting or settlement (sometimes very violent and rapid) as the supporting capabilities of the soil diminished. Liquefiable material at or near the ground surface would need to be replaced or recompacted before the site could be used as structural support. Liquefaction potential in the study area generally is low. Detailed knowledge of site-specific water table and soil conditions would be needed to estimate accurately the potential for liquefaction at any particular location. The above-described conditions that contribute to liquefaction potential are recognized easily during standard subsurface investigations and are relatively easy to reduce, eliminate or avoid.

Landslides, earthslips, mudflows and soilcreeps are all expressions of soil conditions related to the instabilities created by steep slopes, shallow soil development, the presence of an excessive amount of water, or the lack of shear strength in the soil or at the soil/rock interface. Each of these conditions is readily observable in Alameda and Contra Costa Counties, but usually is reported simply as a "landslide." Earthquake activity does induce some landsliding, but most slides result from the weight of rain-saturated soil and rock exceeding the shear strength of the underlying material. Erosion of supporting material at the toe of the landslide or of the landslide-exposed slopes further contributes to instability.

LOS VAQUEROS

The authors of the Los Vaqueros/Kellogg Creek EIR reported the following:

The Los Vaqueros site is underlain by northwest-trending sandstones and shales of the Upper Cretaceous Panoche units. Shales generally occur in topographic lows whereas sandstones form homocinal ridges. The area northeast of the reservoir is a homocinal ridge formed by the Dyer sandstone member. The ridge has been cut by several north-south trending faults that offset the rock units. Most of these faults seem to die out to the south, but some apparently merge with the southeast-trending Brushy Creek fault. A

Los Vaqueros Reservoir would occupy a partially alluviated valley of mostly clays with lesser amounts of silt, sand, and fine gravel that is bounded by the northwest-trending sandstones described above.

According to DWR, local faults show no geologic evidence of recent movement in the last 50,000 - 70,000 years. However, there have been several small earthquakes of a magnitude 1.0-2.6 on the Richter scale along two area faults fairly recently. Most of the damage associated with these quakes was at the east end of the Livermore Valley.

In the period between 1900-1974, the largest earthquake near the project area was a magnitude 5.5 quake about 16.5 miles to the southwest. Other earthquakes recorded within a 10-mile radius of the project area were of magnitude 4.0 or less except for one on the Concord fault north of Mt. Diablo (magnitude 5.4), one near Antioch (magnitude 4.9), and two west of Riggs Canyon (magnitudes 4.1 and 4.3).

The faults capable of producing the maximum bedrock acceleration in the area are the Calaveras fault, located about 14 miles west of the project area, and the San Andreas fault, about 40 miles west of the site.

The Los Vaqueros site is made up predominantly of steeply-sloped alluvial and sedimentary rock. The elevation of the area ranges from about 100 feet MSL to approximately 2,275 MSL at the western edge of the watershed. Soils belong to two soil associations. Soils along Kellogg Creek belong to the Brentwood-Rincon-Zamora association and consist of nearly level to gently sloping well-drained clay loams and silty clay loams on valley fill, alluvial fans, and low terraces. Soils surrounding Kellogg Creek and making up the remainder of the project area belong to the Altamont-Diablo-Fontana association, which consists of strongly-sloping to very steep well-drained clays and silty clay loams that formed in material from soft, fine-grained sandstone and shale on surrounding uplands.

5.4.4 IMPACTS

BUCKHORN PROJECT

Operational Effects

Normal operation of this alternative could have moderately adverse effects on the soils or bedrock at the reservoir site or along the transport pipelines. The potential exists for

reservoir-wall landslides induced by rapid drawdown of the water level. Soil erosion potential also could be increased by rapid drawdown.

An accidental spill of water carried in the transport pipelines could cause soil erosion or mudslides if the breach were situated adjacent to a steep or unstable slope and did not have containment measures, such as diversion levees and auxiliary drains, built into the system. This also would be true for water in surge tanks at the pump stations along the pipelines.

The risk of erosion from a break in a pipeline or a surge tank would vary with the location of the break and the amount of water that escaped from the system. A break and subsequent escape of water in a steep or otherwise unstable area could saturate slide-prone soil or rock, generating damaging slides or mudflows. Pipelines and pump stations located along existing roadways would present a low possibility of breaks occurring in areas of sensitive soils. Pipelines would be laid in engineered-backfilled trenches cut in compacted subsoil or bedrock. These materials have fairly low levels of erosion hazard.

The rock and soil at the reservoir site have a variety of different landslide potentials, most of which are fairly high because of the steep terrain in which it is necessary to locate the reservoir. The likelihood of water-saturation induced landsliding varies with the initial (or reconstructed) stability of the reservoir wall and the speed and frequency of pool drawdown. Rapid drawdown can have a major de-stabilizing effect by creating lubricated slide planes in the soil and rock formations in the reservoir walls exposed by the retreating pool.

Operational Hazards

Environmental geologic or soil factors that could affect this water management alternative include seismic groundshaking, and landsliding. A maximum credible earthquake on one of the major faults, as previously discussed, could damage the storage or transportation facilities. Pipelines could be ruptured or collapsed; tanks could be ruptured, displaced from their foundations or overturned; the reservoir itself could be breached or the spillway cracked; transmission pumps could be displaced. Each of these events could create sufficient damage in part or all of the system to cause a shutdown of the operation

while repairs were made. The environmental effects of such damage are discussed in the Impacts section above. In addition, some further amount of erosion would be expected while the system drained.

A catastrophic dam failure would be unlikely to occur because the structure would be designed to accommodate earthquake loading conditions. It is estimated that peak ground accelerations of about 0.6g would occur for an M7.5 earthquake on the Hayward Fault, and about 0.4g for an M8.25 earthquake on the San Andreas Fault.

Landsliding, either caused by earthquakes or by static slope instability, is probably the most common hazard in the steep areas of the Coast Ranges. Pumping and transportation facilities may be buried by landslide debris from upslope, pulled apart by loss of support as landslide debris falls downslope from facility foundations, or sheared off by subsurface shift of landslide blocks. Buried pipelines are particularly susceptible to subsurface shear.

Slides occurring on the walls of the reservoir could produce a wave high enough to overtop the dam if the slide were very large and the pool level were at maximum height. The effects would be similar to those previously discussed for accidental spills. Additionally, the slide material would reduce the volume of the reservoir by partially filling the pool.

Construction Impacts

This alternative would include the construction of a dam, tunnel and accompanying pipelines and pump stations. Existing access roads and staging areas would be improved and/or expanded during the construction period. The construction would necessitate the disruption of natural surface soils and the underlying bedrock to drive the tunnel, establish firm dam abutments, acquire needed fill from borrow areas, and create stable foundation support for transmission facilities (plant buildings, pump stations, surge tanks, pipelines).

Erosion of exposed soils is a potential impact during the construction period. Stock-piled soil or backfill would be subject to washing off the construction site during periods of rainfall. Walls of open excavations could be subject to washout or collapse, not only from rainwater, but also from groundwater pumped from behind the coffer dams or from the tunnel excavation, if the water table were intercepted. Water used during the dam

construction or tunnel driving process, if it were allowed to escape, also could become a potential source of erosion.

The greatest threat of erosion and sedimentation damage would be at the borrow areas in stream deposits or bedrock outcrops, including those that would be inundated by the rising pool behind the completed dam. At the points where material would be removed, either above or below the future waterline, the exposed surfaces would be subject to the effects of wind and water erosion that could generate soil loss at the site. Dislodged soil washed off the borrow sites, construction or staging areas into adjacent creek channels could cause increased sedimentation downstream. This could increase the turbidity of the creeks and could increase flood hazards in the area where the sediment was deposited, if enough silt were dropped to restrict stream flow. These hazards would be greatest if excavation and construction took place during the rainy months.

Dewatering operations also have the potential to induce mudflowing or landsliding by allowing water to escape from the work site into the surrounding soil. Depending on the locations selected for the downstream facilities, there would be the possibility of generating new slope instability or aggravating existing slope instability if supporting soils were removed from the base of a landslide-prone hillside. Additionally, some of the existing roads in the area pass through landslide-prone terrain. New construction along these routes could be responsible for increasing the amount of slope instability on them by undercutting supporting soils or rock formations.

It is unlikely that the construction would have any adverse effects on the bedrock, other than that previously mentioned with regard to potential landslide generation.

Construction Hazards

The system would be exposed to several major and minor geologic or soil hazards during the construction period. The most significant hazard would be that posed by earthquakes. As indicated in previous descriptions of seismically related impacts, groundshaking effects could disrupt or destroy the system during its operation if appropriate seismic design were not included in the construction of the project. This means that the reservoir, tunnel, and all accessory facilities must be designed to withstand expected vibration from earth-

quakes along the major faults in the region; downstream pipelines must be sufficiently flexible and must have adequate realignment mechanisms for crossing fault traces to reduce to a minimum the possibility of shearing.

Static and seismically induced landsliding, as discussed for operational hazards, would have similar effects on the construction stage of the project.

Additionally, such soil related hazards as high expansiveness, high compressibility, low shear strength and low permeability would affect the design of the foundations and the safety of the excavations for each component of the system. Improperly founded and drained structures would not be expected to perform well under typical seismic and static stability conditions for the area. Weak or saturated supporting soils can cause unacceptable amounts of settlement even without the added stresses of seismic loading. The effects can range from the nuisance level to the major structural damage level including shifted or collapsed foundations. Combined with seismic loads, the effect could be sufficient to make the difference between survival and destruction of a component of the system.

Such soil hazards would be expected to be reduced to a minimum through the use of engineered soils to support the downstream project components. The tunnel and dam would be founded in bedrock and, thus, not exposed to these hazards.

PINOLE PROJECT

Operation

Normal operation of this alternative could have moderately adverse effects on the soils or bedrock at the reservoir site or along the transport pipelines similar to those discussed for the Buckhorn Reservoir alternative. The effects of erosion would be somewhat less than for Buckhorn because the slopes at Pinole are not as steep and the soils are less erosion-prone. However the analysis of the impacts and hazards is so nearly identical for the purposes of environmental review that the reader is referred to the above sections dealing with Buckhorn Reservoir for the information.

Construction

This alternative would have the same general impacts and be exposed to the same general types of geologic and soil hazards during the construction period as the previously described alternative. This includes earthquakes, groundshaking effects, landsliding and such hazards as high expansiveness, high compressibility, low shear strength and low permeability as previously described. The analysis of the impacts and hazards is so nearly identical for the purposes of environmental review that the reader is referred to the above sections dealing with Buckhorn Reservoir for the information.

LOS VAQUEROS

Landslides are common in the larger shale units in the Los Vaqueros Reservoir area, and rapid reservoir drawdown could aggravate old landslides or cause new ones. There are no known or potential slides large enough to adversely affect the project. The drainage area surrounding the reservoir site is not expected to produce significant amounts of sediment. Small amounts of sediment can be expected at the southern end where Kellogg Creek enters the reservoir.

A reservoir at this site has the potential to induce seismic activity. Although the reservoir is fairly small, similar-sized reservoirs in geologically analogous areas (including Northern California) have been associated with seismic events up to magnitude 6, with increased earthquake frequency. Such events have generally been associated with large water level fluctuations over short time periods such as proposed at Los Vaqueros.

The authors found it was not possible, given the state of existing technology, to determine the probability of a reservoir-induced earthquake. Such probability is considered to be rather small, given the large number of reservoirs within the vicinity of this site that have not been associated with earthquakes and that only a few earthquakes worldwide have been associated with the existence of a reservoir. The possibility of reservoir-induced seismic activity cannot be ruled out and, therefore, remains a potentially significant impact of constructing a reservoir at this site.

Project construction could directly affect soils in the inundation area of the reservoir in two ways. If the clay soils, which exist beneath the inundation area, were used to construct the dam. Topsoil would be excavated from the inundation area and transported

to the dam site. If the soils were not used for embankment construction, they would be inundated at the selected reservoir site and, over a period of time, would be covered by silt and debris. Either occurrence would constitute an impact on soil resources because the soils would not be easily restorable. Therefore, an irretrievable commitment of soil resources would occur. The impact was deemed less than significant by the authors because none of the soils in the project area are considered prime, unique, or of statewide importance.

5.4.5 MITIGATION MEASURES

Operational Measures

The operation of the terminal reservoir and the other components of the water management system would be supervised be trained personnel, familiar with hydraulic engineering techniques and the current reliable literature on storage and transport design and procedure. This would provide maximum protection for the soil environments associated with the dam, tunnel, pipelines, pump stations and access roads associated with the project.

Areas of unstable soils and potential landsliding would be identified. Reconstruction of slope areas would take place as necessary. Potentially unstable areas would be monitored during drawdown operations to prevent the de-stabilization of reservoir walls.

The dam would be monitored for reaction to earthquake activity. Appropriate preparations, in the form of an earthquake emergency response plan, would be made (see below).

A detailed Permanent Erosion and Sedimentation Control Plan would be prepared by the project engineer for the erosion-prone areas that could be effected by accidental spills. The Plan would be submitted for review and approval by the Counties in which the project lies. The specific language of such plans varies, but the concepts to be adhered to include those on the following list.

- Locate structures and access roads outside major streams and drainageways.
- Keep storm water runoff velocities low.

- o Trap sediment before it leaves the sites of pump stations with such techniques as check dams, sediment ponds, or siltation basins.
- o Reduce disturbed areas to the minimum necessary for project operation.
- o Stabilize disturbed areas, either by vegetative or mechanical methods.

A detailed Earthquake Preparedness Plan would be prepared by the project operator and would be submitted for review and approval by the Counties. The specific language of such plans varies, but the concepts to be adhered to include those on the following list.

- o Ensure existing and proposed seismic designs meet current county, state and federal standards, where applicable.
- o Make structural and non-structural elements secure from the effects of expected levels of groundshaking.
- o Assign specific personnel primary and back-up responsibilities to be carried out during a seismic emergency.
- o Provide supplies of emergency water, food and shelter for project personnel to remain on-site for at least 3 days.
- o Provide training for personnel in First Aid, CPR and other emergency response procedures.
- o Carry out practice drills of emergency response procedures.

Construction Measures

Identified areas of very steep slopes and existing landslides would be avoided wherever possible and reconstructed wherever they would effect the future safety of the project, the workers, or the downstream population.

The dam, reservoir, tunnel, and downstream facilities (pump stations, pipelines, etc.) would be designed to meet the current standards of the Seismology Committee of The California Structural Engineers Association. Designs would include such concepts as the use of flexible joints or re-alignment sections to cross unstable seismic zones, cross-bracing and reinforced concrete in structures that could be damaged by groundshaking, and the securing of non-structural elements (such as pumps or other heavy equipment) to prevent shifting during earthquake-induced ground motion. The dams would have to meet

the structural requirements of the California Department of Water Resources, Division of Safety of Dams.

The Construction Plan would adhere to the recommendations of a Geotechnical Report prepared for the dams. Recommendations would include site-specific information for the repair of landslides, weak soils and areas of potentially unstable subsoils or materials in the dam site, the tunnel alignment, or near developed property along the downstream facilities. The types of information and recommendations sought would be similar to those on the following list.

- All trenching, grading and site preparation would be done under the direct observation of the soil engineer in accordance with the guide specifications for engineered fill supplied by the geotechnical consultant.
- Weak soils (expansive, compressible, liquefaction-prone) would be over-excavated and replaced with sound material properly keyed and compacted.
- Fill slopes and cut slopes would be inclined no greater than 2:1 unless specifically reviewed and approved by a qualified engineering geologist. Subdrainage and surface drainage should be installed to prevent sloughing or raveling of slopes.
- Storm drainage and subdrainage would be installed and maintained to prevent erosion of fill.
- High fill slopes would be well-compacted to obtain stable surfaces.
- Cut-and-fill slopes would be planted to reduce erosion.
- Foundations suited to soil conditions would be used for all structures.
- Retaining walls would be well-drained and designed to resist pressures appropriate to the size of the backslope.
- After construction sites were graded they would be inspected for expansive soils and rock by a qualified engineer and treated where necessary according to his recommendations.
- Landslides would be stabilized and drained.

Heavy construction when soils are exposed would be limited as much as possible to the time of year when rainfall is minimum -- June through September. Temporary dikes, sedimentation basins, drainage ditches and diversion ditches would be used to control and prevent damage from storm drainage in construction areas. Following construction,

either artificial or vegetative cover would be provided for exposed soils until appropriate natural cover could develop.

The construction sites would be designed to increase the time of concentration through grading, detention areas, energy dissipaters, moderate flow velocities, and so forth.

A detailed Temporary Erosion and Sedimentation Control Plan would be prepared by the project engineer for erosion-prone areas, particularly in or near the staging areas, borrow areas and coffer dam sites. The tunnel mouth and dam abutments would be protected by the coffer dam, but an emergency response version of the erosion control plan should be designed and available. The Plan would be submitted for review and approval by the Counties. The specific language of such plans varies, but the concepts to be adhered to include those on the following list. A Section 1601-03 Agreement with the Department of Fish And Game would be needed to ensure protection of stream habitat from erosion and sedimentation during the construction period.

- Locate staging areas outside major streams and drainageways.
- Reduce disturbed areas to the minimum necessary for project construction.
- Stabilize disturbed areas as quickly as possible, either by vegetative or mechanical methods.
- Discharge construction runoff into small drainages at frequent intervals to avoid buildup of large potentially erosive flows. Minimizing disturbed areas
- Keep storm water runoff velocities low.
- Keep slope lengths and gradients to a minimum.
- Keep runoff away from disturbed areas during construction.
- Trap sediment before it leaves the site with such techniques as check dams, sediment ponds, or siltation basins.

5.5 VEGETATION AND WILDLIFE

Descriptions of vegetation and terrestrial wildlife resources in the proposed project area are based upon field surveys conducted in late April, on May 1 and on July 26, 1987. A wildlife biologist and botanist walked the areas proposed for inundation and associated project facilities (spillways, pumphouse, etc.) areas in a random manner. The field surveys were supplemented with existing data gathered from the California Natural Diversity Data Base (CNDDB), data sources and interviews with representatives of the California Department of Fish and Game (DFG), the Endangered Species Office of the U.S. Fish and Wildlife Service (USFWS), the Audubon Society, the EBMUD Watershed and Recreation Division and other knowledgeable persons. Aerial photographs (1:400) were examined and used to map vegetation and habitat types. A list of plant and animal species both observed and expected to occur within the project areas is provided in Appendix D.

The description of the fish resources in the proposed project area is based on data provided by the DFG, EBMUD and other knowledgeable sources.

5.5.1 SETTING — VEGETATION

BUCKHORN SITE

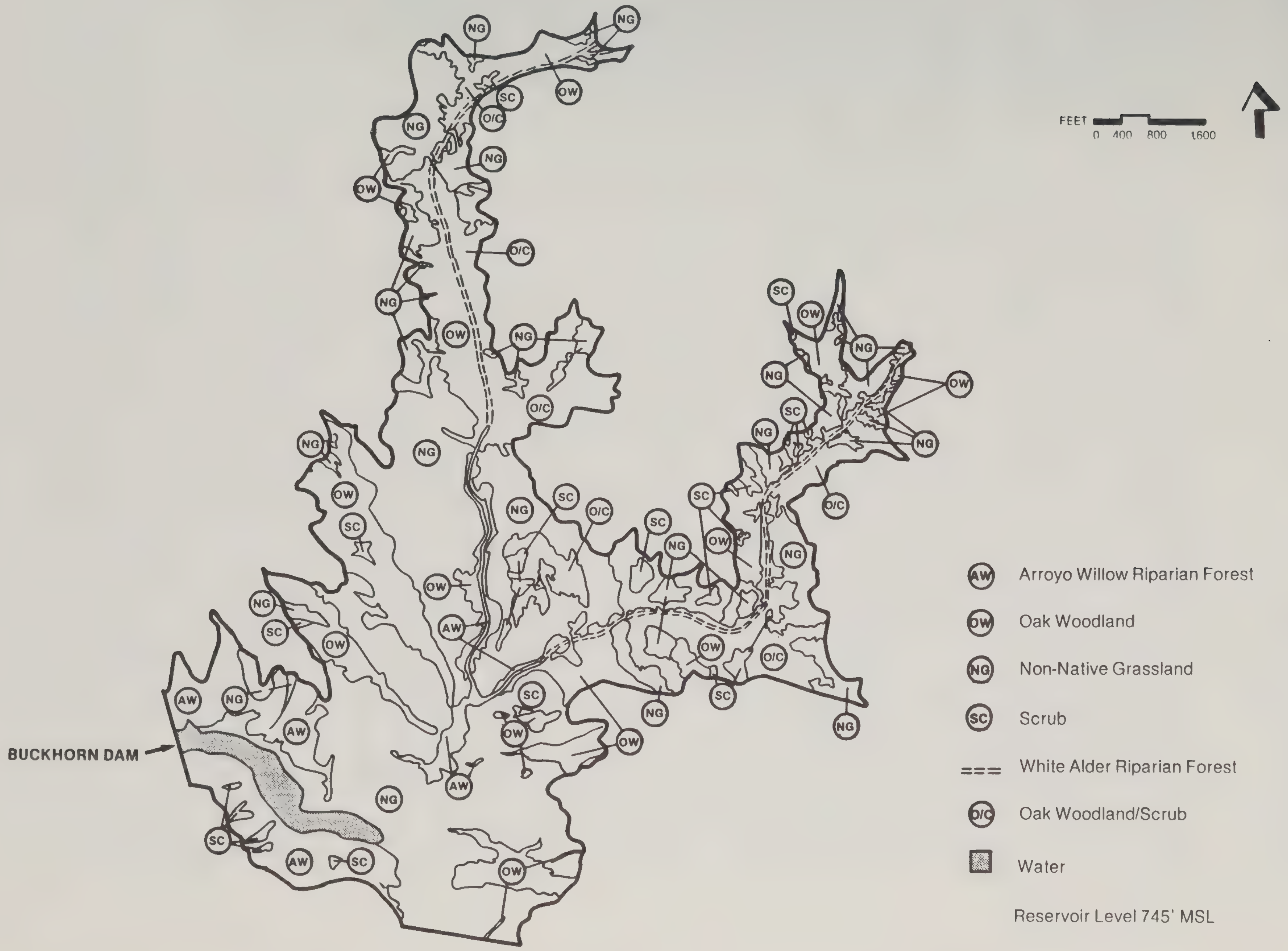
Plant community names are taken from Holland (1986) unless otherwise indicated.

The watershed of Kaiser and Buckhorn Creeks contains several plant communities including Grassland, Mixed Evergreen Forest, Oak Woodland, Coastal Scrub and Chaparral (see Figure 5-11). Grassland and the Oak Woodland/Mixed Evergreen forest form most of the acreage below the 840-ft. level. Riparian habitats dominate the bottom land of both creeks. Some Riparian elements occur in smaller side canyons but these consist mostly of willows (Salix sp.).

The Grassland is dominated by annual grasses and weedy broadleaved species. In some areas filaree (Erodium cicutarium) is the dominant plant. Native species are not common and are widely scattered, being generally more common above the 840 ft. msl (mean sea level). There are a few valley oaks (Quercus lobata) near the Four Corners area along Kaiser Creek.

VEGETATION MAP-BUCKHORN RESERVOIR

FIGURE 5-11



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On the steep slopes of both canyons Coastal Scrub dominates. In places the brush is so thick and the terrain so steep that the vegetation is impenetrable. A few stands along Kaiser Creek are open enough to allow movement but these are not as rich in flora. In the open areas, besides the annual grasses, there are a number of native herbaceous species, including Needlegrass (Stipa sp.) and Melica Grass (Melica sp.). The most extensive stands of Coastal Scrub occur above 900 ft. msl.

The Oak Woodland and Mixed Evergreen Forest areas tend to be a mixture of both vegetation types rather than pure as usually described. Notably missing are Tanoaik (Lithocarpus densiflora), Douglas fir (Pseudotsuga menziesii), and canyon live oak (Quercus chrysolepis) from the Mixed Evergreen Forest, and blue oak (Quercus douglasii) and digger pine (Pinus sabiniana) from the Oak (Foothill) Woodland. Cattle have done a great deal of damage in some areas where the understory is almost completely missing.

Most of the Chaparral in the watershed is found above the 840 ft. msl. It is most common along Old Burn Road between Riley Canyon and Kaiser Creek. Only a small portion of this stand would be within the inundation area.

The Riparian areas are difficult to characterize because the dominant plant species vary along both creeks. The habitats of both Kaiser and Buckhorn Creeks may be considered a mix of Central Coast Live Oak Riparian Forest and White Alder Riparian Forest with the Oak Woodland/Mixed Evergreen Forest on the slopes. White alder (Alnus rhombifolia) is present along both creeks but is more common on Kaiser Creek extending to an elevation above 1,000 ft. msl.

Buckhorn Creek contains mostly Oak Woodland elements in the middle and upper parts. The lower reaches of the creek support a large stand of big leaf maples (Acer macrophyllum).

In the lower parts of both creeks, north and east of Four Corners, willows (Salix sp.) dominate. The area SSW of Four Corners to the present reservoir is Central Coast Arroyo Willow Riparian Forest consisting almost entirely of arroyo willows (Salix lasiolepis).

Cattails, arroyo willow, sedges, nut-sedges and various grasses make up the understory. East of the wetland area there is an upland area dominated by non-native weeds which is highly disturbed.

The proposed tunnel outlet site near Miller Creek supports Coast Live Oak Woodland on the northeast-facing slope with Diablan Sage Scrub on the south and west-facing slopes. Coyote brush is very common in the scrub. Coast Live Oak Forest and California Bay Forest occupy the canyon bottom.

The proposed construction access road from the construction staging area to the proposed dam site along Big Burn Road passes through non-native grassland, chaparral, oak forest, Diablan Sage Scrub and Coast Live Oak Woodland.

Big Burn Road passes through non-native grassland just west of Kaiser Creek Road. To the west of the grassland on the north-facing slopes bitter cherry, service-berry and poison oak occur. These commonly are found with Chaparral, but in this area seem transitional between Coast Live Oak Woodland on the ridge top and Oak Forest on the steeper slopes. Several specimens of Chase's oak (Quercus x chasei) are found in this region.

Professor Rolf W. Benseler of California State University at Hayward has located ten Chase's oak trees in the Big Burn and Kaiser Creek Road areas that range in size from 13-15 inches dbh and 15-35 ft. tall. Chase's oak is a hybrid cross between the California black oak (Q. kelloggii) and the coast live oak (Q. agrifolia), both of which occur in the area. These trees are not recognized as a different species, but rather as rare isolated individuals that have physical characteristics of the coast live oak with a little California black oak mixed in. The biological significance of these trees lies in the infrequency of this hybridization, as compared with the more common hybridization of the coast live oak and the interior live oak (Q. wislizeni). Chaparral occurs on the ridge-crest further to the west, continuing to the dam site. The Chaparral is dominated by brittleleaf manzanita, chamize and a shrubby form of coast live oak.

The northerly-facing slopes of the proposed dam and spillway site have a complex mix of Coast Live Oak Forest, Diablan Sage Scrub and Chaparral. Coast live oak, madrone, bigleaf maple and California bay are the dominant trees. Patches of California sage and coyote brush are common, and poison oak is everywhere.

The south-facing slopes have a more open Coast Live Oak Woodland with patches of Diablan Sage Scrub. Again, poison oak is common in the understory. Manzanita Chaparral does not occur on the south-facing slopes.

The proposed borrow pit sites on upper Kaiser Creek have a more open Coast Live Oak Woodland with sometimes dense patches of Diablan Sage Scrub. The Diablan Scrub is not at all diverse, consisting mainly of California sage, sticky monkey flower and coyote brush. The north and west-facing slopes have a denser Coast Live Oak Forest. Slopes on both sides of the canyon tend to California Bay Forest in the creek bottom. Manzanita Chaparral is not present.

In the drainages of the south-facing slopes arroyo willow and elderberry occur on the moister sites. The riparian habitat is not well developed but it does occur for some distance above the creek bottom.

The blowoff structure site in King Canyon consists totally of non-native grassland. The lower area surrounding the existing reservoir supports a tree farm of Monterey pines. The proposed pipeline that would run north along Camino Pablo Road passes through non-native grassland with some scrub elements and scattered trees. Arroyo willow occurs in some of the wetter drainage areas along the pipeline route.

The proposed Buckhorn Pumping Plant site near St. Mary's College is highly disturbed non-native grassland. Valley oaks occur near Las Trampas creek southeast of the site.

PINOLE SITE

The vast majority of the Pinole Creek site consists of open grassland dominated by annual grasses and weedy herbaceous broadleaved species (see Figure 5-12). The broad bottom land along the creek is planted to hay crops and there is a tree farm east of the Castro Ranch Road intersection.

VEGETATION MAP-PINOLE RESERVOIR

FIGURE 5-12

37056

The northern arm is grazed grassland and on the moister sites there are some native perennial grasses: canary-grass (Phalaris sp.), needle grass, and barley grass (Hordeum brachyantherum). Sedge (Carex sp.), rush (Juncus spp.) and spike rush (Eleocharis sp.) are also present on very wet sites. Willows and small oaks occur in spots along the intermittent creeks in this area. Thistles and other weedy species are especially common on the more disturbed sites. Native species are very rare within the inundation zone.

Very little Coastal Scrub is present on the site, and even where present it is poorly developed, often consisting of a few scattered shrubs.

Most of the Oak Woodland/Mixed Evergreen Forest lies above the 340 ft. msl. There are some areas between Castro Ranch Road and Bear Creek Road on the slopes south of Pinole Creek that would be below the water level. This area contains stands of very large California buckeye (Aesculus californica), California bay (Umbellularia californica) and coast live oak. Scattered stands of valley oak also occur. Two stands of this habitat type occur south of Pinole Valley Road and west of Castro Ranch Road.

The other important community is the Riparian habitat along Pinole Creek. Willows are common and often dominant. California bay is scattered as is coast live oak. The understory is made up of weedy species although some native perennials are present.

The Northern California black walnut (Juglans hindsii) occurs along the creek from the proposed dam site to Bear Creek Road but is most common in the eastern half of the site. There are no large trees, most of them being less than one ft. in diameter. How they got there is open to some speculation. Walter Knight, formerly of the East Bay Regional Park District and noted botanical expert of the region, feels that they are native on the site. It is possible that the parental trees have been cut and the trees now along the creek are secondary growth.

The proposed tunnel exit on Castro Ranch Road would occur in an area of Coast Live Oak Forest and California Bay Forest. California bay and coast live oak are the dominant trees. Madrone (Arbutus menziesii) trees are widely scattered. The understory consists of blackberry, poison oak and snowberry. Elderberry, coyote brush, sticky monkey flower,

California sage and grasses occur on more open sites and on disturbed areas. The upper slopes have a depauperate Diablan Sage Scrub. Willows and California pipevine occur on moist sites in open places along the creek bottom. Manzanita Chaparral is not on this site.

The proposed new road from Castro Ranch Road north to the proposed dam passes through non-native grassland and is heavily grazed. Introduced grasses and some native broadleaved species dominate.

The proposed realignment of Pinole Valley Road along the south shore of the reservoir to Bear Creek Road would pass through several plant communities. The western portion passes through non-native grassland and small patches of Diablan Sage Scrub. The eastern portion is a mix of Coast Live Oak Forest and California Bay Forest. Coast live oak and California bay are the dominant trees, but big leaf maple, black oak, madrone and California buckeye are also present. Poison oak, California hazelnut and snowberry form much of the understory.

The Pinole dam site supports a willow scrub composed of both arroyo and red willow. California bay, coast live oak and valley oak make up the main tree species, but they are widely scattered. Elderberry, blackberry, wild rose, poison oak and coyote brush form the main understory shrubs.

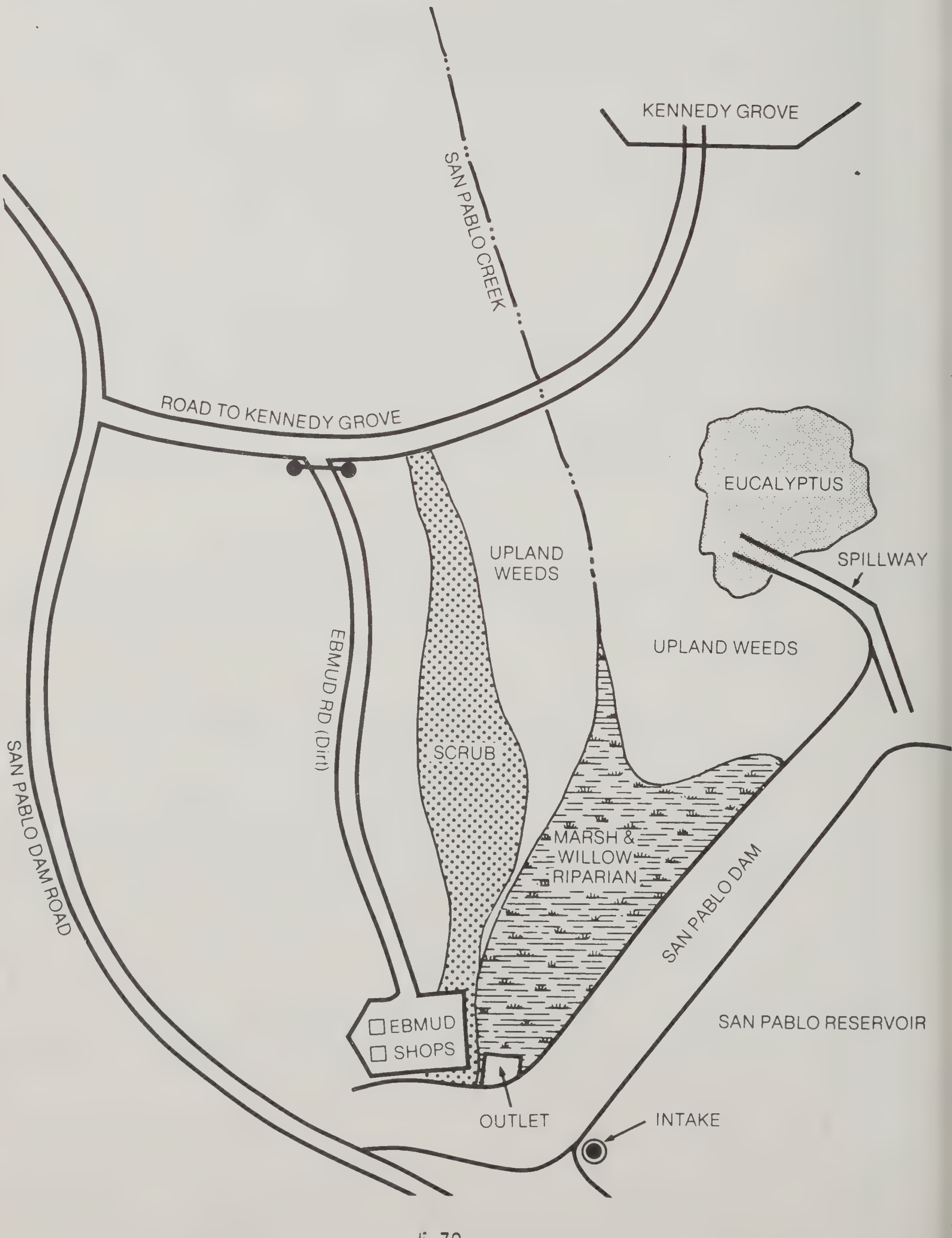
The area surrounding the creek is mostly non-native grassland with some scrub elements present. Most of the area is heavily grazed.

The proposed Pinole pumping plant at the base of the San Pablo Dam supports a Coastal and Valley Freshwater Marsh with some willows, cattails, sedges and nut-sedges being the dominant vegetation. The surrounding area is much drier and consists of weeds common to highly disturbed sites such as bristly ox-tongue, thistle, Italian thistle and weedy grasses (see Figure 5-13).

VEGETATION MAP OF NEW PINOLE PUMPING PLANT GENERAL LOCATION

FIGURE 5-13

NOT TO SCALE



LOS VAQUEROS

The Los Vaqueros/Kellogg Creek Project area is in the California Floristic Province and supports vegetation typical of regions in California with Mediterranean climates. The area occupies a zone of biogeographical transition between southern and northern elements of the Coast Range flora. The area also supports several plant communities typical of the San Joaquin Valley. These are represented in lowland portions of the interior valleys where alkaline soils occur. Of added significance are the presence of several plant and animal taxa (including nine plant taxa such as mesquite, palmer's oak, desert buckwheat, and morman tea) associated with the Mohave desert and arid portions of the south Coast Ranges that reach their northern range limits in the Los Vaqueros/Corral Hollow area.

The Los Vaqueros watershed supports a diverse mosaic of plant communities that reflects its climatic, topographic, and edaphic diversity. The numerous plant associations that occur within the watershed are grouped into communities using DFG's Natural Diversity Data Base (NDDB). The significant Natural communities of the Los Vaqueros area are:

- Iodine bush scrub (remnant)
- Alkali meadow
- Upland native bunchgrass
- Northern claypan vernal pool
- Valley rock outcrop intermittent pool
- Valley oak riparian forest
- Central coast riparian forest

The Los Vaqueros site is also in a region with several special-status plant taxa. Major groups of such taxa known from the area include those associated with habitats on Mt. Diablo and the northern San Joaquin Valley. These include:

o Mt. Diablo manzanita	*Arctostaphylos auriculata*
o Stink bells	*Fritillaria agrestis*
o Mt. Diablo rock rose	*Helianthella canstanea*

Several other significant plant species are known or suspected in the project area including:

- <u>California Native Plant Society Rare but not Endangered Taxa</u>. (16 taxa of known status and 8 of suspected presence)
- <u>Calochortus pulchellus</u> (abundant throughout the project area)
- <u>Palmer's Oak</u> (Quercus dunnii). (northern-most known occurrence of species with closest population over 200 miles distant)

5.5.2 SETTING — TERRESTRIAL WILDLIFE

BUCKHORN SITE

As a result of the variety of plant communities at the project sites and riparian vegetation associated with the creeks, along with a history of protection of the area from hunting, vehicular access, and habitat destruction, wildlife diversity is high. The three-tiered structure of trees, shrubs, and herb layer provides cover and nest sites for many species of birds and the variety of plant species provides a range of food sources for many birds and wildlife. The proximity to water, a limiting factor during the summer for many species of animals, is also a major element of riparian habitat that attracts wildlife. The moisture content of the soil in riparian habitat maintains conditions for soil invertebrates that are used for food by shrews and moles, and allows the presence of moisture-loving amphibians and reptiles.

A list of wildlife observed or expected at the proposed sites is provided in Appendix D.

The inundation area that would result from a dam on Buckhorn Creek contains primarily Grassland and Oak Woodland/Mixed Evergreen Forest habitats. The other habitats include Riparian Woodland and small areas of Coastal Scrub and Chaparral.

Grassland wildlife includes western meadowlark, white-crowned sparrow, California vole, and western fence lizard. Oak Woodland and Mixed Evergreen Forest typically provides habitat for acorn woodpecker, California mouse, black-tailed deer, and gopher snake. Riparian Woodland is habitat for downy woodpecker, raccoon, woodrat, and California

newt. Within Coastal Scrub are found wrentit, bobcat, and alligator lizard. These species, along with Bewick's wren, California thrasher, pinyon mouse, and gray fox are also associated with Chaparral habitat.

The construction access routes along Kaiser Creek and Big Burn Roads have high wildlife use because these roads allow for easy movements through the area. The adjacent habitat contains areas of dense vegetation which often restricts movements of wildlife. Foxes, coyotes, and deer use this dirt road as they forage for food. Western fence lizards dash along the edges to maintain body temperatures optimal for their activities. No kangaroo rat activity is evident. The dry, rocky soils in this area are primarily clayey and are not habitat for kangaroo rats, which typically require loose, sandy soils. Other rodents such as deer mice, California pocket mice, Upland harvest mice, house mice, brush mice, and pinyon mice may utilize this habitat.

The proposed construction staging area is a disturbed weedy spot providing limited wildlife habitat. Gophers, deer mice, goldfinches and house finches capitalize on the weedy food sources found there. Nearby, sensitive wetlands associated with the dam spillway structure and Miller Creek provide habitat for redwing blackbirds, Pacific treefrogs, and other wetland species.

The proposed Riley Ridge Outlet Tunnel portal is within Coastal Scrub and Oak Woodland habitat utilized by a variety of wildlife (as previously described for other areas of the project).

The borrow pit sites are steep, containing patches of Coastal Scrub habitat useful for a variety of wildlife. There is potential for use of these areas by the state threatened Alameda striped racer. However, no observations of these wary snakes was made in field studies undertaken on July 29, 1987.

The proposed pipeline to the Buckhorn Pumping Plant along Amino Pablo Road is an unpaved road through Grasslands and a Christmas tree plantation. There is little use by wildlife in this highly managed area. A few small drainages with small amounts of riparian habitat valuable for wildlife is also found along this alignment. The proposed

blowoff structure would be located in Grassland and the Christmas tree plantation; both habitats of low wildlife value.

The proposed Buckhorn Pumping Plant side would be located within a grassy field with walnut trees located along the road. It is adjacent to Las Trampas Creek. The nearby area is low density residential, with St. Mary's college to the south. Adaptable wildlife species such as scrub jay, house finch, ground squirrel, house mouse, and raccoon utilize the site.

PINOLE SITE

The proposed reservoir site is dominated by Annual Grassland and Riparian habitat. Grassland is primarily utilized by meadowlark, California vole, and red-tail hawk. The Botta pocket gopher, raccoon, and California newt are typical species that would be expected to use Riparian habitat. Wildlife expected on the project site are listed in Appendix D.

The tunnel exit point is located adjacent to Castro Ranch Road. The habitat is generally vegetated with large California bay trees and associated Riparian understory plants. Some Coastal Scrub and disturbed areas are also found here. Observations of or other evidence of black-tailed deer, raccoon, brown towhee, and scrub jay were noted. A diverse assemblage of wildlife species would be expected because of the presence of a permanent water source and the close arrangement of a variety of plant communities. This area is considered of high value for wildlife.

The proposed realignment of Castro Ranch Road would pass through Annual Grasslands that are utilized by meadowlark, gopher, California vole, and red-tail hawk.

The dam site supports Willow Scrub habitat with adjacent disturbed habitat of orchard trees. Mourning dove, red fox, scrub jay, purple finch and lesser goldfinch utilize this mixture of habitats. In addition, a patch of Coastal Scrub provides habitat for chestnut-backed chickadee, scrub jay, and western fence lizard. Alameda striped racers were not observed but may utilize this area. A variety of other wildlife species is expected to utilize this area because of the water source that is available. Great blue herons use the

aquatic habitat, and pond turtles may also be found here. The outlet structure would be located in a flat portion of Pinole Creek where pools form that are utilized by waterfowl and egrets and potentially by pond turtles.

The proposed realignment of Pinole Valley Road would follow the southern edge of the proposed reservoir. It would cut through a mosaic of vegetation, much of it Oak Forest and Coastal Scrub communities, with some Annual Grassland at the western end. This mosaic of plant communities supports many wildlife species because of the diverse range of habitats that are found there.

The proposed Pinole Pumping Plant site near San Pablo Road below San Pablo Reservoir would be located on disturbed land containing introduced weedy species and Coastal Scrub plants. Adjacent to the existing Sobrante Aqueduct, this habitat supports red-wing blackbirds, song sparrow, purple finch and lesser goldfinch. There is some potential for Alameda striped racer use of the Coastal Scrub habitat, although none was observed.

LOS VAQUEROS SITE

Due to its location between coastal and interior habitats, the Los Vaqueros area contains a diversity of species and habitats characteristic of several ecoregions. The area has biotic elements of local and regional significance that are recognized and protected in adjacent natural areas including Mt. Diablo State Park, Corral Hollow Ecological Reserve, and the Antioch Dunes unit of the San Francisco National Wildlife Refuge.

The habitats and animals of the watershed were studied intensively by DFG during 1979-82.

A complete inventory and analysis of the area's wildlife was presented in the La Vaqueros/Kellogg Creek EIR. Seventeen important wildlife species were identified including several federally-designated special-status species (Bald Eagle, Peregrine falcon and San Joaquin kit fox) and many candidate special-status species including:

California Tiger salamander
California Red-legged frog
Western pond turtle
Alameda striped racer

Ferruginous hawk
Long-billed curlew
Tricolored blackbird
Townsend's Western big-eared bat
San Joaquin pocket mouse
Curve-footed Hygrotis diving beetle

Other wildlife species included the Golden eagle, Prairie falcon, 16 other raptors, waterfowl, deer and four species of Branchinectra shrimp.

5.5.3 SETTING — AQUATIC WILDLIFE

BUCKHORN SITE

The major creek drainages within the proposed reservoir are Buckhorn and Kaiser Creeks. There are no known fish population surveys on these two creeks; however there have been surveys conducted on San Leandro Creek and Redwood Creek above Upper San Leandro Reservoir. The fish species collected in these survey efforts are expected to occur in Buckhorn and Kaiser Creeks as well. Collected fish species include: Sacramento sucker, three-spined stickleback, California roach, sculpin, bluegill, mosquito fish, large mouth bass and rainbow trout. The principal fishery in these creeks and their tributaries would be the rainbow trout which make up an estimated 95% of the total fish population. These and all other creeks of Upper San Leandro Reservoir support a rather unique assemblage of fish species in the Bay area that, except for the mosquito fish, is dominated by native species. A second unique feature of the fishery resources of the Upper San Leandro Reservoir and its tributaries is that they support a unique population of non-hybridized coastal (steelhead) rainbow trout (Salmo irideus) that has been isolated from migrating steelhead for over 112 years (since the construction of Chabot Dam in 1875). The genetic profiles of these trout strongly suggest that these fish are direct descendants of the native California steelhead with unprecedented genetic integrity. This genetic strain of rainbow trout has not been contaminated with the hatchery strain of rainbow (steelhead) trout (Salmo gairdnerii), now common in waterways throughout the world. The Salmo irideus population in Redwood Creek has been given State historical landmark status (#970) because of its significance as the original genetic stock from which the steelhead trout hatchery was developed.

The *Salmo irideus* are known to migrate to and spawn in Kaiser and Redwood Creeks and the spawning trout of upper San Leandro, Buckhorn, Moraga and Indian Creeks are assumed to be *Salmo irideus* as well. In the winter of 1987 EBMUD personnel conducted a spawning habitat survey of Buckhorn and Kaiser Creeks and their tributaries. Based on this survey, it was estimated that there are approximately 26,000 ft. of suitable spawning habitat along the creeks in the proposed project area: 12,000 ft. along Kaiser and Buckhorn Creeks and an additional 2,000 ft. along the McHugh, Two Dog and Callahan tributaries. Detailed surveys of trout spawning and rearing habitats or population counts have not been conducted on Buckhorn or Kaiser Creeks to date.

PINOLE SITE

Pinole Creek runs through the center of the proposed Pinole Reservoir site. The last fish survey of this creek was conducted in 1979 by the California Department of Fish and Game. The fish species found in Pinole Creek at that time are as follows: three-spined stickleback, California roach, sculpin, mosquito fish, Sacramento squaw fish, goldfish, golden shiner, white catfish, carp, green sunfish, brown bullhead and the Sacramento sucker. A remnant spawning run of steelhead trout is suspected to persist in the creek, although the creek has not been surveyed recently to confirm this. Steelhead trout were planted in the creek in 1979 and again in 1984 by DFG and EBMUD.

LOS VAQUEROS

Kellogg Creek is the major creek system in the project area. Typical of systems of the west San Joaquin Valley foothills, the creek is ephemeral except in very wet years; it becomes intermittent by mid-summer, confining resident fish to shallow, isolated pools. The creek is heavily used by livestock throughout the year; livestock grazing has increased turbidity and nutrient levels, and impacted riparian vegetation and channel structure for over a century. Both native and introduced fish species present are those able to tolerate warm, slow-moving, or stagnant water with low dissolved oxygen concentrations, dense algal growth, and severe disturbance. All species are resident year-round.

Over 200 small ponds are present in the project area. Most are man-made impoundments supplied by rainwater, springs, or canals. With few exceptions, they are heavily used by livestock throughout the year. Resident fish are mostly introduced species that tolerate disturbed conditions.

5.5.4 THREATENED AND ENDANGERED SPECIES

BUCKHORN AND PINOLE SITES

There is one listed animal species, Aleutian Canada goose, under the U.S. Endangered Species Act (1973) known to occur in the Pinole Reservoir project area. There are a number of plant and animal species that are candidates for listing under the U.S. Endangered Species Act known to occur in both project areas. Some of these federal candidate species are listed as either endangered or threatened by the State of California under its Endangered Species Act (1971).

A list of rare plant and animal species known to occur in the project area is provided in Table 5-4. The following is a short discussion of some of the rare species found or most likely to be found in the project sites.

Northern California Black Walnut. Near the junction of Kaiser Creek Road and the road to Ramage Peak stands a large Walnut tree which is believed to be the Northern California black walnut (*Juglans hindsii*). The tree has a diameter at breast height (dbh) of 2.75 ft. but is mostly dead in the upper branches. The Pinole site supports a large stand of Juglans hindsii along Pinole Creek as noted above. This native tree and the Eastern walnut (*J. nigra*) are commonly used as the root stock for commercial orchards of the English walnut (*J. regia*). All of the walnut species commonly interbreed creating hybrid varieties and making the identification of species very difficult. Because of this taxonomic problem, the CNDDB has elected not to consider this species as a distinct species and thus does not list it in their data inventories. The plant is however listed by the CNPS and is a candidate for federal listing. Some believe that there are but three native stands of this species remaining in California. If the stand in Pinole Creek is a native stand, then it would be the fourth such native stand.

TABLE 5-4

RARE, ENDANGERED OR THREATENED SPECIES KNOWN TO OCCUR IN THE PROJECT REGION[1]

Taxa	Status[2]	Notes
PLANTS		
Alameda manzanita (Arctostaphylos pallida)	E/C2/List 1	(See text.)
Santa Cruz tarweed (Holocarpha macradenia)	E/C1/List 1	Native populations are rare and there are transplanted populations in the Berkeley-Oakland Hills. Occurs in open grasslands and blooms June-November. Likelihood of occurring in project areas is low because the two sites are located too far inland outside of the coastal fog zone which the plant is believed to favor.[3] The plant was not observed during the July field survey.
Diablo rock rose (Helianthella castenea)	/C2/List 1	Occurs on grassy hillsides and valleys of the San Francisco Bay region. Blooms April-May. This plant was not observed during the field surveys.
Brewer dwarf flax (Hesperolinon Breweri)	/C2/List 1	Occurs on grassy or brushy slopes on serpentine soils. Blooms May-July. There are no serpentine soils in the project areas, therefore the likelihood of disturbance is low. This plant was not found at either site during the field surveys.
Mt. Diablo fairy lantern (Calochortus pulchellus)	/ /List 4	This plant is known to occur in rock outcrops within ft.hill woodlands and chaparral. It blooms from April-June. It was not found on either site during the field surveys.
Northern California black walnut (Juglans hindsii)	/C2/List 1	(See text.)

TABLE 5-4 (continued)

Taxa	Status[2]	Notes
PLANTS (continued)		
Western leatherwood (*Dirca occidentalis*)	/ /List 4	(See text.)
ANIMALS		
Alameda striped racer (*Masticophis lateralis ecryxanthus*)	T/C2/	(See text.)
Peregrine falcon (*Falco peregrinus anatum*)	E/E/	Known to winter in the hills and hunt near marshes. May hunt in the project area but no known nesting sites in the vicinity of project areas.
Berkeley kangaroo rat (*Dipodomys Hermanni Berkeleyenis*)	/ /Watch List	(See text.)
Golden Eagle (*Aquila chrysaetos*)	/ /Protected	A pair of birds is known to occupy the remote hills of the Rocky Ridge region near the proposed Buckhorn Reservoir.[4] A pair of golden eagles are reported to be nesting in the Simas Valley area north of the Pinole Reservoir site.[5] A single bird was last seen in 1986 during the Audubon Christmas count. Golden eagles have been seen repeatedly in the Pinole Valley site throughout 1987.
Black-shouldered kite (*Elanus leucurus*)	/ /SSC	(See text.)
Northern harrier (*Circus cyaneus*)	/ /SSC	(See text.)
Double-crested cormorant (*Phalacrocorax auritus*)	/ /SSC	(see text.)
Cooper's hawk (*Accipiter cooperi*)	/ /SSC	(See text.)
Sharp-shinned hawk (*Accipiter striatus*)	/ /SSC	(See text.)

TABLE 5-4 (continued)

Taxa	Status[2]	Notes
ANIMALS (continued)		
Aleutian Canada goose (Branta canadensis leucopareia)	/E/	(See text.)
Red-legged frog (Rana aurora)	/ /Watch List	(See text.)
Western Pond Turtle (Clemmys marmorata)	/C2/Watch List	(See text.)

[1]California Natural Diversity Data Base (CNDDB), California Department of Fish and Game.
Alameda County Planning Department, Draft Environmental Resources Background Report, 1986.

[2]State/Federal/Other:

State:

California Endangered Species Act (1984), Native Plant Protection Act (1977), and the California Environmental Quality Act.

R = Rare. Plants that although not currently Threatened are in such small numbers or restricted habitats that they may become Threatened or Endangered if present conditions continue.

T = Threatened Plants or animals likely to become Endangered in the foreseeable future in the absence of protection action(s).

E = Endangered. Seriously in danger of becoming extinct.

Federal:

Federal Endangered Species Act of 1973, as amended.

E = Taxa formally listed as Endangered.

T = Taxa formally listed as Threatened

C1 = Candidate taxa for which there is enough information to support the biological appropriateness of proposing to list as Threatened or Endangered.

C2 = Candidate taxa for which there is biological information that indicates that proposing to list the taxa as Threatened or Endangered is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate listing.

C3 = Taxa that are no longer under consideration for listing. There are three subcategories, depending on reason(s) for removal from consideration:

3A = Taxa believed to be extinct.

TABLE 5-4 (continued)

3B = Taxa with taxonomic problems that do not meet the Endangered Species Act definition of a "species."

3C = Taxa that are too common or widespread and/or those not subject to any identifiable threat(s).

Other:

Section 15380 of the California Environmental Quality Act [CEQA (September, 1983)] has a discussion regarding non-listed (State) taxa. This section states that a plant (or animal) must be treated as Rare or Endangered even if it is not officially listed as such. If a person (or organization) provides information showing that a taxa meets the State's definitions and criteria, then the taxa should be treated as such in an EIR.

SSC = Species of Special Concern

The California Native Plant Society (CNPS) Inventory of Rare and Endangered Vascular Plants (1985).

List 1 = Plants of Highest Priority.

List 1A = Plants presumed Extinct in California.

List 1B = Plants Rare or Endangered in California and elsewhere.

List 2 = Plants Rare or Endangered in California, more common elsewhere.

List 3 = Plants for which more information is needed.

List 4 = Plants of limited distribution (a watch list).

Watch List = Animals with a limited range and which are suspected of being threatened. At this time these species have no official legal standing.

[3] Neil Havlick, Plant Ecologist, East Bay Regional Parks, telephone communication, April, 1987.

[4] R. Jackson, Educational land use survey, EBMUD Educational Advisory Committee.

[5] Robert Nuzum. Wildlife Superintendent, EBMUD. Conversation on 5/19/87.

Alameda Manzanita. A thorough search was made for *Arctostaphylos pallida* which occurs on Sobrante Ridge and is associated with brittleleaf manzanita there. No *A. pallida* was found on either site. On the Kaiser/Buckhorn site the only Chaparral occurs on the Big Burn Road and *A. pallida* was not found there.

Western Leatherwood. Western leatherwood is reported from the Berkeley/Oakland Hills and the San Leandro Hills. It seems unlikely to occur on the Pinole site but on the Kaiser/Buckhorn site it could occur on the Woodland portion of the access road and on the

slopes surrounding the Kaiser Creek arm of Upper San Leandro Reservoir. It is possible, but unlikely, that it would occur further inland. Western leatherwood can easily be located during its bloom period from January to March when its yellow flowers can be seen from a distance.

Alameda Striped Racer. The Alameda striped racer is known from Leonard Park in Oakland, 5 miles west of the center of the proposed Buckhorn reservoir. Suitable habitat for this snake occurs at the Buckhorn Reservoir site and at the High Pinole pumping plant site. This species has a spotty distribution within the valleys, foothills, and low mountains of the Coast Range east of San Francisco Bay, west of the Central Valley in Contra Costa and Alameda Counties. The range of this species is restricted to an area that is rapidly being developed by urbanization and water impoundments.

Chiefly a snake of the foothills, the preferred habitat of the Alameda striped racer is Coastal Scrub/Riparian Woodland ecotones. It is also found in scattered brushlands, grassy patches, and rocky gullies or stream courses. This species is active diurnally. It sometimes seeks shelter among rocks or in burrows. The striped racer feeds primarily upon fence lizards, but may also prey on other species of lizards, snakes, small mammals, birds, and probably insects. This snake is not typically found in high densities, and its wariness limits its detection.

Patches of the striped racer's preferred habitats—Coastal Scrub and Chaparral—were especially surveyed for this species. No individuals were observed. Only one small area of Chaparral would be affected by the inundation of the Buckhorn site. A portion of this habitat, located along Big Burn Road, would be inundated by high waters of the reservoir. Other potential Alameda striped racer habitat is found in scattered ravines in small drainages to Buckhorn and Kaiser Creeks.

Because the Alameda striped racer is typically difficult to observe, and because it is found in low densities, lack of observations at preferred sites does not mean that it is not present. In 1975, the Alameda striped racer was spotted 2.5 miles east of the project site just south of Los Trampas Peak. Patches of Chaparral and Coastal Scrub may provide habitat for this species within and adjacent to potentially inundated areas.

Western Pond Turtle. The Western pond turtle may inhabit pools along the creeks or small cattle watering ponds within the two proposed inundation areas. It is highly aquatic, primarily associated with marshes, creeks, and ponds lined with emergent vegetation. No observations of Western pond turtles were made within the Kaiser/Buckhorn Creek site but it was observed at the Pinole site.

Red-Legged Frog. The red-legged frog is also a highly aquatic animal that may be found on the project site. This species especially requires quiet pools in permanent streams or ponds at least three feet deep. No frogs or tadpoles of this species were observed at either site.

Black-shouldered Kite. Black-shouldered kite is a probable resident of both sites. Although not listed as threatened or endangered, large fluctuations in populations of this species over the past fifty years have drawn attention to the potential endangerment of this raptor. These birds feed primarily on rodents in Grasslands and nest and roost in Riparian corridors.

Northern Harrier. The northern harrier has greatly declined in California, especially around San Francisco Bay. It is considered in the highest priority of "Birds Species of Concern" and was on the "Blue List" from 1972 to 1986. Loss of grassland and marsh habitat is the probable reason for the decline of this species. It is probably a resident at the Buckhorn site as well as at the Pinole site.

Berkeley Kangaroo Rat. The Berkeley kangaroo rat is a little-known small hopping rodent of the East Bay Hills. It was apparently more widespread in Berkeley when the Berkeley Hills were grass and brush covered and were grazed by cattle. Other locations include the edge of Calaveras Reservoir near the southern border of Alameda County with Santa Clara County. No recent studies on the status or distribution of this species have been done, although it is presently known to exist in low numbers on Mount Diablo.

Kangaroo rats are extremely nocturnal, and are typically associated with mixtures of grasslands and brushy habitats. They generally prefer loose, sandy soils in which they dig tunnels. At the mouth of the tunnels is generally a mound of excavated earth. They

generally utilize "edge" habitat, for example, areas between Grassland and Coastal scrub. They also forage along roadways, often following automobile tire tracks for seeds that they have turned up. Their distinctive paired tracks and trail drag marks are generally apparent in dirt roadways where they exist. Neither tracks nor dens were observed during the field surveys and the soil substrate is not suitable in many areas of the project sites.

Aleutian Canada Goose. The Aleutian Canada goose was listed as endangered by the U.S. Fish and Wildlife Service on March 11, 1967. The only known breeding populations occur on three tiny islands in the Aleutian chain off the coast of Alaska. The decline in numbers of Aleutian Canada geese are largely attributed to predation by arctic foxes introduced into the geese breeding areas. Other factors that have contributed to the decline of this species include loss of wintering habitat.

During their migrations these birds utilize specific areas in California and Southern Oregon. The available marking and banding data indicate that the Crescent City area in Northern California is a major spring staging area. The Crescent City area and the Butte Sink area in the Sacramento Valley are used heavily in fall migration, and the Modesto area in the San Joaquin Valley is a main wintering site.

Aleutian Canada geese have been sighted on the Nunes Ranch, immediately south of the proposed Pinole Reservoir site. In 1985-86 these birds were first sighted at this site in November and last sighted in late January. A peak population of 139 birds was counted on 20 December. The geese feed in the pastures and rest in a small stock pond on the Nunes Ranch during the day and are suspected of roosting on San Pablo Reservoir at night. Four of these birds were captured and banded in January 1986. All four of these birds were later seen in the Modesto area in February and three of the birds were sighted in the Crescent City area in the spring. The U.S. Fish and Wildlife Service is planning to continue the monitoring and banding of this population.

Double-crested Cormorant. This bird has been observed in the Upper San Leandro Reservoir area during the 1984 and 1985 Audubon Christmas bird count (see Appendix D). It is classified as a species of special concern by the California Department of Fish and Game because its breeding population has been on a decline. Reasons for the decline are

habitat destruction and human disturbance. The preferred nesting habitat for this bird is rock ledges on cliffs or rugged slopes or tall trees beside water bodies. This bird has not been reported nesting in the Upper San Leandro Reservoir, although the habitat appears to be ideal. The birds observed in 1984 and 1985 are expected to be winter migrants.

Cooper's Hawk. An individual Cooper's hawk was reported in the Upper San Leandro Reservoir area in 1984 (see Appendix D). This species is classified as a Species of Special Concern because of a declining breeding population. One reason for the decline of this species is the loss of its nesting habitat, Lowland Riparian areas. The bird observed during the Audubon Christmas Count is believed to have been a winter migrant. Suitable nesting habitat does occur in the riparian areas however.

Sharp-shinned Hawk. A pair of sharp-shinned hawks were observed in the Upper San Leandro Reservoir area in 1985 and a single individual was observed in 1986. This bird is classified as a Species of Special Concern in California because of a declining breeding population. It prefers to nest in young, even-aged conifer stands that have little ground cover, near water, a typically Sierran phenomenon. A small breeding population once occurred in Contra Costa County and northern Alameda County but has apparently disappeared. The birds observed during the Audubon Christmas Counts are believed to be winter migrants. Suitable nesting habitat is limited in the project area.

An osprey (*Pandion haliaetus*) nesting platform has been erected by EBMUD near the mouth of Riley Canyon just south of the project site. The platform was inspected and it does not appear that it has been used in the recent past.

5.5.5 IMPACTS

BUCKHORN PROJECT

Terrestrial Habitat

The proposed Buckhorn Reservoir would eliminate approximately 1,124 acres of native vegetation and wildlife habitat. The estimated acreage of each habitat type that would be inundated by the reservoir is presented in Table 5-5.

As indicated in Table 5-5, the proposed reservoir would inundate and eliminate approximately 34 acres of riparian habitat, a habitat type of relatively high value as compared to the other terrestrial habitats in the reservoir area. In the past the USFWS has identified this type of habitat as a resource of high wildlife values and placed it in Category 2, amongst those habitats which the agency intends to protect against any loss of in-kind habitat values. The riparian habitat loss is judged to be significant.

As the reservoir area is cleared, animals will move out of the inundation area and onto adjacent lands. Some of these species would be able to populate suitable habitats in the surrounding areas provided that the surrounding areas are not already fully occupied or at carrying capacity. When the surrounding areas are at or near capacity, competition for food, increased predation and disease would reduce the successful relocation of some species. It is very difficult to estimate how many of the wildlife species now residing within the reservoir area would be able to avoid being impacted by the loss of habitat. A safe assumption would be that the surrounding lands are at or near the same population levels as the inundation areas and any additional competition for food and cover would probably result in some reduction in population levels for the area as a whole.

The dam and associated features would eliminate additional native habitat areas, most of which would be limited in area (less than 5 acres in size) and within habitats common to this region. Exceptions to this would be along the proposed dam access road and the proposed construction staging area.

The proposed improvements to the access road to the southern dam abutment would likely eliminate most of the Chase oaks (Quercus x chasei) mapped in the area. Although this oak is of some botanical taxonomic significance, the loss of these trees would not represent as significant an impact as the loss of an endangered species.

The proposed construction staging area would be located very near a wetland habitat along Miller Creek at the base of the existing Upper San Leandro Dam. It is estimated that an area of approximately three acres would be required. There are more than three acres of disturbed upland habitat between the existing road and the wetland and thus there should be no reason to directly impact this habitat type at this site.

TABLE 5-5

HABITAT LOSS DUE TO RESERVOIR INUNDATION[1]

Buckhorn Site	Pinole Site
Willow Riparian = 14 Acres	Grassland = 614 Acres
Alder Riparian = 20 Acres	Oak Woodland = 28 Acres
Scrub = 22 Acres	Scrub = 2 Acres
Grassland = 520 Acres	Willow Riparian = 34 Acres
Oak Woodland = 350 Acres	Riparian/Oak Woodland = 20 Acres
Oak Woodland/Scrub = 168 Acres	Oak Woodland/Scrub = 6 Acres
Water = 30 Acres	Agricultural Fields = 156 Acres
TOTAL = 1,124 Acres	TOTAL = 860 Acres

[1]Habitat mapping was done on a 1:400 scale aerial photo and acreage figures were determined via a planimeter on the same scale.

Ground disturbance activities at each of the construction sites are likely to result in soil erosion, and the storage and use of heavy earth moving equipment introduces the potential for oil and petroleum spills. Both the silt and petroleum products could then be deposited in nearby creeks during storm events. The aquatic habitats downstream of the sites could be degraded as a result of the silt being deposited in the creek bed and the pollution levels of the creeks being elevated.

Although no threatened or endangered plant or animal species were observed during the field surveys, suitable habitat (scrub) for the state threatened Alameda striped racer does occur in the reservoir inundation area as well as the borrow pit sites. Although this snake was not observed during the field surveys, its presence within the areas of suitable habitat cannot be dismissed. This snake typically occurs in low densities and is rather reclusive in nature and thus it is difficult to observe. The loss of the scrub habitat on the site could result in negative impacts to the Alameda striped racer.

Other rare species that have been observed in the project area include the Northern California black walnut, black-shouldered kite, northern harrier, and Cooper's hawk. The proposed reservoir would inundate and eliminate the lone Northern California black walnut tree found on the site. Although this plant would be eliminated by the project this is not considered to be a significant impact. The one plant in an area of historic human inhabitance would suggest that this tree was planted and is not native to the site.

The proposed reservoir would eliminate nesting and hunting habitats for the black-shouldered kite and the Cooper's hawk. It would likely increase habitat for the northern harrier. Of these impacts, the loss of the potential nesting habitat (riparian vegetation) for the Cooper's hawk is considered the most significant warranting mitigation. The loss of habitat for the black-shouldered kite and the potential increase in habitat for the northern harrier are not considered to represent a change in habitat areas which would significantly threaten or benefit the species.

Suitable habitat for the western leatherwood tree (Dirca occidentalis) occurs throughout the project area. Although this species was not found on the site during the field surveys, it may be due to the fact that at the time of year that the surveys were conducted this species is very hard to locate. Individuals if not stands of this tree may occur within the reservoir inundation area and would be eliminated.

Aquatic Habitat

The proposed reservoir would inundate and destroy all but about 1,000 ft. (or approximately 3-4%) of the total rainbow trout spawning habitat available in the Buckhorn and Kaiser Creek watersheds. The proposed dam would effectively isolate the fish populations in the Buckhorn reservoir from the Upper San Leandro (USL) reservoir, and would preclude the use of remaining spawning areas in the Buckhorn and Kaiser watersheds by fish from the USL reservoir. This would effectively eliminate one of the more protected spawning areas in the USL reservoir watershed. The other major creek tributaries to the USL reservoir, Redwood, Orinda, and Upper San Leandro Creeks, are located near public roadways or adjacent to private lands and are thus more susceptible to disturbances such as siltation and water pollution. The Buckhorn and Kaiser Creek watersheds are not near any public roads and are largely owned by EBMUD. Because no

information is available on the use of potential spawning habitat on Buckhorn and Kaiser, the significance of the adverse effects on the isolated trout population is difficult to assess.

PINOLE PROJECT

Terrestrial Habitat

The proposed Pinole Reservoir would eliminate approximately 860 acres of terrestrial vegetation and wildlife habitat and replace it with the aquatic habitat of the reservoir. The estimated acreage of each habitat type that would be inundated by the reservoir is presented in Table 5-3. This reservoir would eliminate approximately 54 acres of riparian habitat. This habitat is attributed a greater wildlife value than the other terrestrial habitats on the site, and is of limited extent in the state. The loss of this habitat and its wildlife values are considered to be significant, requiring mitigation to result in no net loss of in-kind habitat values.

As in the case with the Buckhorn Reservoir, the filling of the reservoir would result in some reduction in wildlife populations in the area as a whole.

The dam and associated project features would eliminate additional native habitat areas, most of which would be limited in area (less than 5 acres in size) and within habitats common in this region. Exceptions to this would be the proposed realignment of Pinole Valley Road along the southern border of the reservoir, the habitats around and immediately adjacent to the tunnel exit portal, and the proposed pumping plant site.

The realignment of the Pinole Valley Road to the southern border of the reservoir would pass through a mosaic of vegetation communities, much of it being Oak Woodland habitat. This diverse range of habitat types supports a similar range of wildlife species. The tunnel exit portal site also supports a wide range of habitat types and wildlife species, and thus disturbances to these sites would result in greater impacts to the wildlife communities in comparison to other project related sites.

The proposed pumping plant site at the base of San Pablo Dam would be located southwest of San Pablo Creek and would be approximately one-half acre in size (76 x 33-ft.). With

careful siting this structure could be placed within an area that was disturbed and now supports weeds and scrub. There does not appear to be any need to disturb the existing wetland areas at the base of the dam or along San Pablo Creek.

Ground disturbance activities at each of the construction sites are likely to result in soil erosion, and the storage and use of heavy earth moving equipment introduces the potential for oil and petroleum spills. Both the silt and petroleum products could then be deposited into nearby creeks during storm events. The aquatic habitats downstream of the sites could be degraded as a result of the silt being deposited in the creek bed and the pollution levels of the creeks being elevated.

Although no listed threatened or endangered plant or animal species were observed during the field surveys, suitable habitat (scrub) for the state threatened Alameda striped racer does occur at the dam and spillway sites as well as in the pumping plant site. Although this snake was not observed during the field surveys, its presence within the areas of suitable habitat cannot be dismissed. This snake typically occurs in low densities and is rather reclusive in nature and thus it is difficult to observe. The loss of the scrub habitat on the site could result in negative impacts to the Alameda striped racer.

The endangered Aleutian Canada goose is known to rest and feed in nearby fields and small stock ponds just south of the proposed reservoir inundation area during its winter migration. These geese may also feed and rest within the reservoir inundation area; to date, however, this area has not been surveyed during the period when the geese are known to occur there. These geese are believed to be very sensitive to human intrusions and loud noises. They would appear to avoid using the Scow Canyon arm of the San Pablo Reservoir when there are boats in this portion of the reservoir. Observations of the sensitivity of these birds to loud noises have been made in the Modesto area where a roosting site was disturbed by airplanes taking off at a nearby airport. The proposed dam site is approximately three-quarters of a mile northwest of the area where these birds are known to occur. Construction noises other than explosions are not expected to disturb the geese. Like many species of birds, these geese can become accustomed to continuous or frequently repeated noises. The frequent truck traffic along Castro Ranch Road is not expected to disturb the geese because the nature of these noises would be rather frequent (see Section 5.6, Traffic and Access), and the road is not visible from the ponds.

The stand of Northern California black walnut along Pinole Creek may well be a significant resource if it is indeed a native stand and was not planted or introduced. There are but three such native stands known to occur in California, although the tree itself has been introduced throughout the state. The loss of this stand of trees would be significant. Further historical work would be required to determine if this is a native stand as suspected.

Aquatic Habitat

The western pond turtle was observed along Pinole Creek during the field surveys. The reservoir would inundate and destroy the habitat and populations of this locally rare species if mitigation measures are not implemented. Suitable hunting and nesting habitats for the black-shouldered kite would also be destroyed within the reservoir area as well.

Pinole Creek has not been surveyed recently to determine if a viable steelhead trout spawning run occurs in the reservoir portion of this creek. Assuming at least a remnant run persists along this creek, the dam would block the migration route for these fish and eliminate some portion of the spawning habitat. The proposed dam and reservoir could also adversely affect the downstream spawning habitats if the water releases are inadequate to support the spawning run.

LOS VAQUEROS

Terrestrial Habitat

Loss of habitat through flooding by impounded waters would be the major impact on vegetation and wildlife. Disturbance of additional habitat would occur during construction. The most sensitive habitats likely to be inundated include 15 acres of riparian habitat, 6 acres of ponds or marshes and 24 acres of oak woodland out of a total of approximately 1,700 inundated acres. Several special status plants could be adversely affected.

Aquatic Habitat

Potential construction-related impacts are primarily related to water quality. Excessive sediment quantities deposited in or near stream channels can degrade aquatic habitats.

Construction activities could potentially increase erosion processes, thereby causing increased sedimentation and turbidity in nearby streams and ponds. Excavation and staging area dam, road, and canal construction could increase sedimentation. Construction materials such as concrete, sealants, oil, and paint could impact water quality, as could organic materials such as cleared vegetation. Natural, low summer flows would amplify potential water quality impacts resulting from spills because there would be less dilution. The fish fauna in Kellogg Creek and the ponds is comprised of fishes that are generally adapted to poor aquatic habitat conditions. Nonetheless, increased sedimentation could reduce the distribution and/or abundance of some or all of the fish fauna present.

If Los Vaqueros Reservoir were constructed, Kellogg Creek would be inundated for three to six miles. The flowing stream habitat would be replaced by reservoir habitat in the inundation zone. Because all of the species found in Kellogg Creek can maintain populations in reservoirs as well, fish diversity may not be reduced. Nearby Contra Loma Reservoir maintains populations of all of these species with the possible exception of Sacramento sucker and three-spined stickleback. Fish productivity would increase in the reservoir over the low productivity found in the degraded habitat of Kellogg Creek.

5.5.6 MITIGATION MEASURES

BUCKHORN

Various mitigation measures should be implemented to minimize or eliminate the most significant impacts identified above. In some cases specific mitigation measures can not be identified at this time because specific details of the project impacts are not identifiable. In such cases, mitigation guidelines and or further evaluation efforts are defined so that specific mitigation measures can be identified at some future date.

Loss of Terrestrial Habitats. Approximately 1,060 acres of upland terrestrial habitats would be converted to the aquatic habitat of the reservoir area. This loss of habitat to terrestrial wildlife species in the area may be minimized by increasing the wildlife habitat values of the surrounding upland areas. EBMUD has prepared a Wildlife Management Plan for all of its lands. This plan identifies a number of objectives including the long-term development of wildlife feeding, shelter and nesting habitat units where adequate habitat

does not currently exist or is in limited supply. The principal means of achieving this objective is through the establishment of a mosaic of vegetation communities and successional stages. The planting of specific plant species that are favored by wildlife species and/or the manipulation of existing habitat areas to increase the diversity of habitat types within an area are two common ways of increasing the wildlife values of specific areas. The EBMUD Plan identifies a number of alternative means to improve the wildlife habitat values. Specific habitat enhancement measures that should be applied to the lands around the Buckhorn Reservoir site should be developed in consultation with the California Department of Fish and Game.

Loss of Riparian Habitat. The loss of the riparian habitat within the reservoir inundation area should be mitigated by enhancing and/or creating riparian habitat elsewhere. These riparian compensation areas should be of equivalent habitat values as those riparian habitats that would be lost. The habitat values of the riparian areas that would be lost must be determined. At minimum this would be an acre-for-acre value. Hence, in this case the compensation area would be at least 34 acres in size. It is very likely, however, that the actual area required to fully compensate for the loss of the existing habitat values would be much larger. The California Department of Fish and Game (DFG) and the U.S. Fish and Wildlife Service should be consulted in the development of this mitigation plan to assure the plan will meet their goals and objectives. This is especially true if a Section 404 (of the Clean Water Grant Act) permit from the U.S. Army Corps of Engineers would be required. This cooperative effort would also facilitate securing the Section 1601-03 streambed alteration agreement with DFG.

EBMUD should meet with representatives of the various resource and permitting agencies to initiate the permitting process. EBMUD should identify suitable areas for riparian habitat enhancement and/or development and present these findings to the agencies. The principal guidelines for suitable areas would be: areas within the same or nearby watersheds are preferable, areas within public ownership would be preferable to those in private ownership, and some means of protection and management must be incorporated in the plan to assure that the mitigation areas would persist as a valuable resource for the life of the project.

Downstream Degradation of Aquatic Habitats Due to Construction Activities. Potential soil erosion and petroleum spills at construction sites and subsequent creek siltation and water pollution can be minimized with the implementation of an effective soil erosion and pollution control plan. See Section 5.4 for details on these plans.

Rare Species. Potential impacts to rare species are not expected to be significant or require stringent mitigation measures. The three most significant rare species that could potentially be effected by the project are the Alameda striped racer, the Cooper's hawk and the western leatherwood shrub. The mitigation measures addressing the riparian vegetation should also address potential impacts to the Cooper's hawk nesting areas. Prior to project construction and final approvals, a more detailed survey for the Alameda striped racer and the leatherwood shrub should be conducted. The survey for the leatherwood shrub should be conducted when the plant is in bloom (January - March). If a large stand of these trees is found on the site, suitable mitigation measures should be developed at that time.

Fisheries. Mitigation for the loss of spawning habitat on Kaiser and Buckhorn Creeks can best be achieved by improving spawning habitat on some of the other tributaries of the Upper San Leandro Reservoir. Examples of potential habitat enhancement opportunities include: pumping of water to the headwaters of the east fork of Redwood Creek in Redwood Regional Park, and to Wildcat Creek in Wildcat Regional Park where the Salmo irideus has been introduced by the East Bay Regional Parks District; removal and improvement of the culvert under Canyon Road on Indian Creek to allow fish to pass upstream; creation of more summer pooling and gravel spawning areas along the various creeks. Upper San Leandro Creek is a major spawning run for the trout but it has a number of degraded areas associated with the private land-holdings in the Canyon community. This is an area that produces a large amount of soil erosion and silt, and some of the septic systems are adding pollutants to the creek. Solutions to these problems would improve the creek spawning areas; however, it would be very hard to maintain and control activities on the private properties along this creek.

There is essentially no opportunity to improve the creek bed habitat of Kaiser Creek above the area of inundation. This stretch of the creek has a steep gradient and is

dominated by plunge pools and a rocky substrate. Trout would not be able to successfully negotiate their way upstream on this creek.

It may be possible to improve the spawning habitat above the inundation area on Buckhorn Creek by conveying more water upstream. It was estimated that there is less than 1000 ft. of suitable spawning habitat available on this creek above the inundation area. Consequently, such a mitigation effort would only replace approximately 3% to 4% of the available spawning habitat that would be lost in the event that the dam is built.

The final fish mitigation plan should be developed in consultation with the DFG and approved by DFG.

PINOLE

Various mitigation measures should be implemented to minimize or eliminate the most significant impacts identified. In some cases specific mitigation measures can not be identified at this time because specific details of the project impacts are not identifiable. In such cases, mitigation guidelines and or further evaluation efforts are defined so that specific mitigation measures can be identified at some future date.

<u>Loss of Wildlife Habitat and Riparian Areas</u>. Mitigation measures for these impacts are identical to those described for the Buckhorn site.

<u>Downstream Degradation of Aquatic Habitats due to Construction Activities</u>. Mitigation measures for these potential impacts are identical to those identified for the Buckhorn site.

<u>Rare Species</u>. Explosives should not be used at the construction site during the time that the Aleutian Canada geese are using the area.

Prior to final project approvals a field survey of the reservoir inundation area, especially stock ponds and scrub areas, should be conducted to determine whether these areas are also being used by the Aleutian Canadian geese and Alameda striped racer.

More historical research is needed to determine if the stand of Northern California black walnuts is native. If it is determined that this stand is native as suspected, then suitable mitigation measures would have to be developed. The only possible mitigation measure would be the preservation of another similar stand.

The population of Western pond turtles should be rescued from the site and transplanted to a suitable site elsewhere.

Fisheries. Pinole Creek should be surveyed to determine if steelhead trout are using the reservoir portion of the creek as a spawning area. If so, then habitat improvements to the downstream and upstream areas of the creek should be implemented as mitigation for the loss of spawning habitat. There should also be a means of allowing the fish to migrate upstream past the dam, such as a fish ladder and or capture and transport program.

The DFG would have to be consulted to determine what minimum flow releases from the dam would be required to maintain the fishery resources downstream.

LOS VAQUEROS

A number of mitigation measures were suggested to reduce the extent or severity of impacts to plant communities, special-status plant species, and other important species, as well as endangered wildlife. These included: additional surveys at all sites; minimal areas of construction disruption; further purchase and/or management of watershed (or adjacent) areas for preservation of important communities as in-kind mitigation for losses; and restriction of access to important botanical and biologically sensitive areas.

Even with implementation of such measures, it was felt that a potentially significant impact on vegetation and wildlife could occur following mitigation.

The authors found that the flooding of important wildlife habitats would constitute a significant adverse impact that cannot be fully offset by mitigation. The most important losses include reduction of potential or occupied kit fox habitat, habitat occupied by federal candidate species including California red-legged frog, California tiger salamander, western pond turtle, San Joaquin pocket mouse,, and ferruginous hawk, and loss of various amounts of habitats important to many wildlife species including riparian areas, vernal pools, ponds, marshes, and grasslands.

5.6 TRAFFIC AND ACCESS

5.6.1 SETTING

BUCKHORN SITE

Access to the project site would be via Castro Valley Boulevard, Redwood Road, Pinehurst Road, Canyon Road, Camino Pablo, Moraga Way, and Moraga Road. Figure 5-14 shows the transportation setting for the proposed Buckhorn Reservoir. Access from the North would be from State Route 24, through Moraga Way or Moraga Road, connecting to Canyon Road and then Camino Pablo. The southern access would be via I-580, Castro Valley Boulevard, and Redwood Road. There are no posted restrictions on heavy vehicles on these access roads.

<u>I-580 and State Route 24 Freeways</u>

State Route 24 and I-580 lie some 12 to 13 miles north and south of the project site, respectively. I-580 is a six- to eight-lane freeway carrying an annual average daily traffic (ADT) of 86,000 vehicles. During the peak hours traffic is congested over the Dublin Pass.

State Route 24 is an eight-lane freeway carrying an ADT of 180,000 vehicles. In the A.M. peak hour, it is congested in the westbound direction, while in the PM peak hour the eastbound direction is heavily congested especially at the Caldecott Tunnel and I-680 interchange.

<u>Castro Valley Boulevard</u>

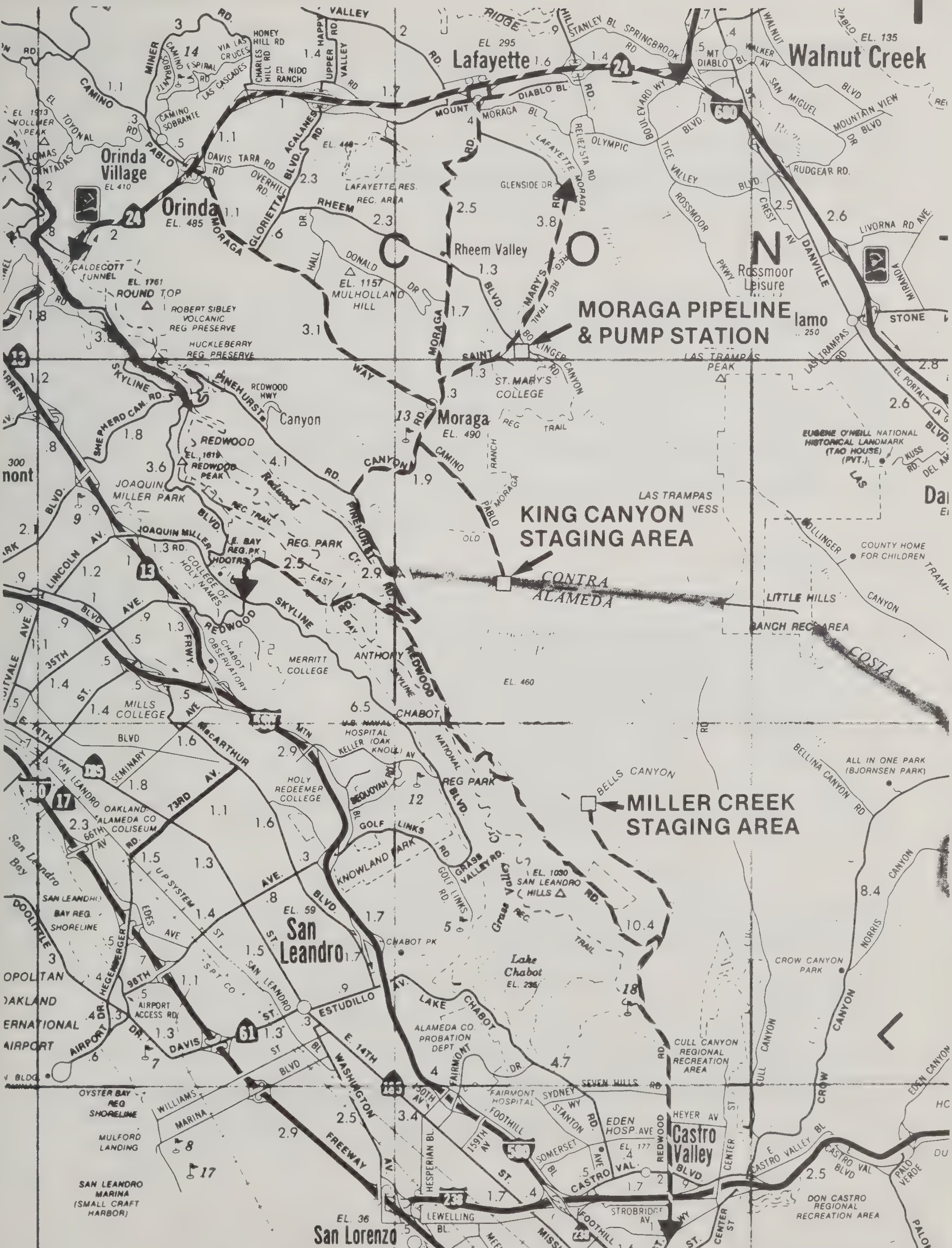
Castro Valley Boulevard is a major four-lane arterial with a median, and unmetered parking and 2-hour limit parking spaces on both sides. It has a speed limit of 35 mph. There are commercial stores and restaurants on both sides of it. Most of its major intersections are signalized. Existing volume is about 33,000-35,000 vehicles per day.

<u>Redwood Road</u>

Redwood Road is a four-lane arterial between Camino Alta Mira and Castro Valley Boulevard, and passes through a predominantly residential area. The capacity of this segment lies in the range of 20,000-25,000 vehicles per day. The existing traffic volume

TRANSPORTATION SETTING: BUCKHORN PROJECT

FIGURE 5-14



ranges from about 5,000 vehicles a day at the north end to about 23,000 vehicles per day near its intersection with Castro Valley Boulevard.

Redwood Road between Camino Alta Mira and the Willows Golf Course is a highly improved two lane arterial with a speed limit of 35 miles per hour. From the Willows Golf Course to Pinehurst Road, it becomes a 20-24 ft. wide rural road with a much lower traffic volume.

The posted speed limit along the length of Redwood Road is 35 miles per hour (mph), except where there is a school in the vicinity, in which case the posted speed limit is reduced to 25 mph. There are traffic signals at all major intersections between Seven Hills Road and the I-580 westbound on and off ramps. There is currently only one stop sign for traffic on Redwood Road near the Chabot Park entrance, where due to a landslide the roadway width is reduced to one lane.

Pinehurst Road

Pinehurst Road is a narrow 20-24 ft. wide two-lane winding road with no shoulders, connecting Redwood Road to Canyon Road. Due to the curving and mountainous nature of some segments of this road, the passage of trucks is difficult. The posted speed limit is 35 mph. The road is frequently used by bicycle riders.

Canyon Road

Canyon Road is a four-lane divided arterial with bike lanes between Moraga Way and Camino Pablo. The CCCTA 106 bus line runs along this section of Canyon Road. The speed limit is 35 mph with a 25 mph section when children are present. An adult school crossing guard is stationed at Camino Pablo. Canyon Road is a two-lane rural road with no paved shoulders south of Camino Pablo.

Camino Pablo

Camino Pablo is a four-lane arterial decreasing to two lanes in its southern portions. It passes through a major residential area. For most of its length, few houses front on it, but toward its southern end, there are several houses fronting on it. There are also two

schools fronting this street and at these locations a 25 mph school speed limit is posted. There are parking spaces and bikeways on both sides of the street and a median in its center for part of its length. This road is also served by the Contra Costa County Transit Agency (CCCTA) bus line 106. A total of 12 streets and 48 driveways access Camino Pablo. Slightly less than half of these driveways and streets have no alternative access.

Moraga Way

Moraga Way is a two-lane arterial with an ADT of about 20,000 vehicles per day between Glorietta Boulevard and State Route 24 in Orinda, and 15,000 vehicles per day south towards Moraga. AM and PM peak hour volumes and congestion are heavy at its north end, just south of State Route 24. A CCCTA bus line runs along this street. Between Glorietta Boulevard and Moraga Road there are several signalized intersections. The posted speed limit is 35 mph everywhere except from Woodland Street to School Street because of a nearby school. Children frequently cross the street and ride their bikes along the roadway shoulders when school is in session.

Moraga Road

Moraga Road is a two-lane arterial that passes through residential communities with schools nearby. The speed limit is generally 35 mph with reductions to 25 mph where schools front on it. South of Saint Mary's Road, Moraga Road widens to four lanes, divided with bike lanes. There are traffic signals at the intersections of Moraga Road with Saint Mary's Road and with Moraga Way. The Moraga Shopping Center fronts on Moraga Road and Moraga Way. The CCCTA 106 bus line runs along Moraga Road.

Saint Mary's Road

Saint Mary's Road is a two-lane arterial with a speed limit of 35 mph between Moraga Road and Rheem Boulevard. The Lafayette-Moraga Recreational Trail parallels this road. Two access points to the trail plus access to a city park are located along Saint Mary's Road, south of Rheem Boulevard. Three streets intersect with Saint Mary's Road south of Rheem Boulevard, of which two have no other access. There are 20 driveways accessing Saint Mary's Road south of Rheem Boulevard including the Moraga Library, a pre-school, single-family homes, and an apartment/condominium complex.

PINOLE SITE

The proposed reservoir site is approximately 6 miles south of I-80. The major access roads are Pinole Valley Road from the north, and San Pablo Dam Road, Castro Ranch Road, Alhambra Valley Road, and Bear Creek Road from the south. Figure 5-15 shows the site location and the major access roads. Currently, all access roads with the exception of Pinole Valley Road have no vehicular weight restrictions. Pinole Valley Road, within the jurisdiction of the City of Pinole, is restricted to vehicles weighing under 7 tons.

Interstate 80 Freeway

I-80 is a six-lane freeway carrying 101,000 to 116,000 vehicles a day between Appian Way and State Route 4 interchanges. The freeway is congested in the eastbound direction in the afternoon and in the westbound direction in the morning.

Pinole Valley Road

This road passes through residential neighborhoods, and a commercial area within the Pinole City limits. Two schools also front on this road. Pinole Valley Road is a two-lane arterial street with a posted speed limit of 35 miles per hour (mph) east of Simas Avenue. At Savage Avenue the speed limit is reduced to 25 mph when children are present. West of Simas Avenue, Pinole Valley Road is a four-lane arterial with a posted speed limit of 25 mph. At Simas Avenue there is a four-way stop sign. There is a traffic signal at the I-80 freeway westbound ramps. Outside of Pinole, Pinole Valley Road is 2 lanes and has a 35 mph speed limit.

San Pablo Dam Road

This road has a 35 mph speed limit and four lanes plus paved shoulders north of Castro Ranch Road. Several homes front on San Pablo Dam Road, and it passes through the El Sobrante commercial center. South of Castro Ranch Road, the road narrows the two lanes and has a 45 mph speed limit. San Pablo Dam Road carries about 15,000 vehicles a day at the Castro Ranch Road intersection. The road's capacity at this point is about 17,000 to 22,000 vehicles per day. The San Pablo Dam Road is served by the AT Transit bus lines 71, and L-1C, plus supplementary service on school days only. Castro Ranch Road stops

TRANSPORTATION SETTING: PINOLE PROJECT

FIGURE 5-15

87056

for San Pablo Dam Road. There are school crosswalks at this intersection. At Tri Lane the speed limit increases to 55 mph. Within Orinda the road narrows, passes through a residential area, and the speed limit drops to 25 mph.

Castro Ranch Road

Castro Ranch Road is a two-lane road directly accessing the project site. It has a capacity range of 5,000 to 7,000 vehicles per day. It carries 1,900 to 3,500 vehicles per day. The posted speed limit is 35 mph. This road passes by Olinda School and the Carriage Hills subdivision.

Alhambra Valley Road

This is a 20- to 24-ft. wide, two lane road from Alhambra Valley Road to Garcia Ranch Road with a posted speed limit of 25 mph. South of Garcia Ranch Road it is built to rural highway standards with a speed limit of 55 mph.

LOS VAQUEROS

Vasco Road is a north-south oriented roadway that connects I-580 to State Route 4. It is a well constructed two-lane road with minor to moderate grades, narrow shoulders, and many curves. It receives high levels of truck traffic (10% of the total volumes). It is used by traffic traveling between the industrial areas of Antioch and Pittsburg, and various South Bay communities. It is also used by some commuters who live in the Stockton/Lodi area and work in the South Bay. May 1985 traffic counts indicated average daily traffic (ADT) of 3,050 vehicles traveling north and 2,271 vehicles traveling southbound. Directional peak-hour traffic volumes occurred southbound in the mornings with 448 vehicles/hour, and northbound in the evening with 491 vehicles/hour.

Morgan Territory Road, oriented in a northwest-southeast direction between Marsh Creek Road and Highland Road, is used primarily by local residential traffic. It is an old road that averages about 12 feet in width and is characterized by steep grades and many sharp curves. Traffic volumes are low. Traffic counts in June 1984 showed ADT fairly evenly divided, with 618 vehicles traveling southbound and 581 vehicles northbound. Traffic counts also showed that peak-hour morning traffic occurred in the northbound direction with 79 vehicles/hour, while the evening peak-hour count of 78 vehicles/hour occurred in the southbound direction. There were ten accidents on this road in 1985, seven in 1984.

5.6.2 POTENTIAL TRAFFIC IMPACTS

BUCKHORN PROJECT

The primary traffic impacts of the proposed reservoir and pipeline would occur during construction. Once completed and operational the reservoir would require only occasional visits to the site to check on its operation and to perform maintenance.

The construction phase of the reservoir is expected to last about four years as described in Section 5.1.2. The first year of site preparation would be relatively less intense than the following two to three years of earthfill and tunnel construction.

Since it is expected that the appropriate earthfill can be found on site the major traffic to and from the site through Castro Valley would consist of trucks bringing in aggregate and equipment, and construction workers commuting to the job site.

The truck traffic would consist of many different size vehicles, however the aggregate would probably be brought in on 25 ton trucks. Construction workers would be coming to the site primarily in their own private vehicles.

Construction Traffic Trip Generation

It was estimated in Section 5.1.2 that an average of 60 truck loads a day would be coming to the site throughout the construction period. This translates into about 120 truck trips (one trip in and one trip out for each truck load). During peak construction periods truck traffic could double to 240 trips a day. This peak might endure for about a year.

As stated in Section 5.1.2 a peak work force of about 270 workers is anticipated. Assuming 1.2 workers per vehicle and a single shift each day, this translates into about 450 daily vehicle trips. Double shifting on the site would double the trips.

About 99% of the construction traffic will be accessing the site from the Miller Creek Staging area next to the Upper San Leandro Reservoir Dam. Less than 1% would be accessing the site from Camino Pablo Road and King Canyon.

Miller Creek Staging Area

Construction access to the main Miller Creek Road staging area would be from the I-580 freeway to Redwood Road, and Redwood Road to the project site. Most of the construction materials would probably be coming from the Pleasanton area so truck traffic would have to use Castro Valley Boulevard to access the eastbound on- and off-ramps to I-580. Westbound traffic can access I-580 directly at Redwood Road.

The total 690 daily vehicle trips that the construction project might generate would increase traffic volumes on Redwood Road by about 15%, north of Seven Hills Road, and by 2% to 4%, just north of Castro Valley Boulevard. Daily traffic on Castro Valley Boulevard would be increased by about 1% to 2% over current levels. The I-580 freeway would be impacted by less than 1%.

Redwood Road is a residential street for part of its length north of Castro Valley Boulevard and an increase in heavy truck traffic of 120 to 240 daily truck trips would represent a potentially significant impact.

King Canyon Staging Area

Approximately 25 workers and a total of 250 truck loads would be involved in the construction of the tunnel at King Canyon. The work would probably be accomplished in three shifts, thus no more than eight to ten workers might be on the site at one time for the estimated six month construction period. The 250 truck loads would average to about two truck loads or four truck trips per working day. The workers would generate about 40 daily vehicle trips assuming 1.2 workers per vehicle.

The drilling equipment for the tunnel would be hauled in once to the site and then once out again along Camino Pablo Road. The width of the equipment would probably mean that it would be an "oversize" truck load requiring special permits and handling during transport.

All of the construction traffic to King Canyon would access the site via Camino Pablo Road. The majority of this traffic would then use either Moraga Road or Moraga Way to access the State Route 24 freeway. Both these routes involve passing through downtown

Orinda or Lafayette where traffic congestion can be heavy during morning and evening peak hours.

The King Canyon staging area construction traffic would add less than 1% to the existing daily traffic on Moraga Road. There is no available data on the current daily traffic volumes on Camino Pablo Road, so construction traffic cannot be compared to existing volumes on these roads.

Camino Pablo is a residential street with schools and houses fronting on it for approximately one-half of its two-mile length. The potential four truck trips a day plus up to 40 trips daily by workers as well as pipeline construction on this street would represent a potentially significant impact.

Pipeline Construction Impacts

King Canyon Pipeline

Pipeline construction would impact 2.2 miles of Camino Pablo, one-half mile of Canyon Road, one-half mile of Moraga Road and 1.1 miles of Saint Mary's Road. Construction would require a ten-foot wide working area and open trench approximately 500 to 750 ft. long. It would take about six months to complete the construction. Approximately 48 driveways and 12 intersecting streets on Camino Pablo, five side streets on Canyon and Moraga Roads, and 20 driveways and three side streets would be impacted by the construction.

The construction of the pipeline from King Canyon to the proposed pumping plant at Saint Mary's College would also generate additional construction traffic along the proposed route (Camino Pablo, Moraga, and Saint Mary's Roads). The construction would involve temporary lane closures, and flagging (for one-way traffic), where street pavement needs to be torn up for the pipeline. Driveways and cross streets along the route would be temporarily disrupted and some closed for short durations. As access to Joaquin Moraga, Camino Pablo schools and St. Mary's College could be temporarily impaired during pipeline construction, careful scheduling of excavation and installation will be required.

Access to the city library, city park, schools and the Lafayette-Moraga Recreational Trail would be impacted by the pipeline construction. Electrical power and vehicle detection loops may be temporarily interrupted by construction at the two signals along the proposed route (Moraga Way/Canyon and Moraga Road/Saint Mary's Road).

For critical facilities, the disruption can be minimized by scheduling the construction periods to avoid peak hours. Jacking or tunnelling under critical driveways or streets or provision of steel trench bridges would maintain 24-hour access.

Road Structure Impacts

Since much of the proposed aggregate hauling for the project will potentially be in 25 ton trucks the strength of the existing pavement and bridges for the main access roads to the project sites needs to be determined. Sections of Redwood Road, Camino Pablo and other roads need to be checked to determine what structural improvements may be needed to carry the proposed construction traffic, and what repairs may be needed afterwards. The remaining arterials appear to be fully improved, but their condition should be reviewed with the appropriate agency staff.

PINOLE PROJECT

The primary traffic impacts of the proposed reservoir would occur during construction. Once completed and operational the reservoir facilities would require only occasional visits to the site to check on its operation and to perform maintenance.

The construction phase of the reservoir is expected to last about three years as described in Section 5.1.4. The first year of site preparation would be relatively less intense than the following two years of earthfill and tunnel construction.

Since it is expected that the appropriate earthfill can be found on-site, the major traffic to and from the site would consist of trucks bringing in aggregate and equipment, construction workers commuting to the job site, and construction of a tie-in pipeline.

The truck traffic would consist of many different size vehicles, however the aggregate would probably be transported in 25 ton trucks. Construction workers would be arriving and departing to the site primarily in private vehicles.

Construction Traffic Trip Generation

It was estimated in Section 5.1.4 that an average of 20 truck loads a day would be arriving at the site throughout the construction period. This translates into about 40 truck trips (one trip in and one trip out for each truck load). During peak construction periods truck traffic could double to 80 trips a day. This peak might continue for about one year.

As stated in Section 5.1.4 a peak work force of about 225 workers is anticipated. Assuming 1.2 workers per vehicle and a single shift each day, this translates into about 375 daily vehicle trips. Double shifting on the site would approximately double the trips.

The construction worker and truck trips would total about 455 daily vehicle trips for the construction phase of the proposed project.

Distribution of Construction Traffic

The primary access route would be Pinole Valley Road since it provides the most direct connection to the Interstate 80 freeway. This road however could not be used by truck traffic without a special permit from the City of Pinole, because it is currently restricted to vehicles under seven tons. This load limit is due to the street pavement design and the easternmost bridge on this road (which will be replaced in about a year once funding is obtained). Pinole Valley Road is also a heavily travelled residential arterial with several homes and a high school fronting it, thus making it an undesirable route for heavy construction traffic.

An alternate access route for heavy truck traffic would be Castro Ranch Road and San Pablo Dam Road. This route, although more circuitous and passing through the El Sobrante commercial center, would provide the necessary access between I-80 (and the likely Vallejo source of aggregate) and the project site. San Pablo Dam Road is also fronted by residence but it is four lanes wide west of Castro Ranch Road and a portion of it (within the City of San Pablo) is a designated truck route.

Traffic Increases

Construction worker commute traffic (375 trips) would increase existing daily volumes on Pinole Valley Road by about 12% at the easterly Pinole City limits, and to a lesser extent

west of there. The additional traffic on Pinole Valley Road could be a significant impact in light of the high school, businesses, and residences fronting this street. Additional traffic counts are needed within the City of Pinole to more fully determine the impacts within the city.

Existing daily traffic on San Pablo Dam Road would be increased by less than 1%, assuming that all the construction truck traffic (80 trips) would use San Pablo Dam Road. Castro Ranch Road traffic would be increased by about 2% over current levels.

Peak hour congestion is a problem on San Pablo Dam Road at Appian Way, and through El Sobrante's commercial center. The reservoir's construction traffic could significantly impact this situation unless scheduled to avoid the peak hours.

The total construction traffic would represent less than 1% of the current 101,000 to 116,000 daily vehicles trips using the Interstate 80 freeway in Pinole.

Pipeline Construction Impacts

Construction of 4,000 LF of new tie-in pipeline along Castro Ranch Road would probably involve some street work, which could require signing and traffic control personnel. Access to several cross streets and driveways, and the nearby Olinda School might be temporarily impaired during construction. Portions of Castro Ranch Road may be temporarily reduced to a single lane with flagpersons.

Road Structure Impacts

Since much of the proposed aggregate hauling for the project will potentially be in 25-ton trucks the strength of the existing pavement and bridges for the main access roads to the project sites needs to be determined. Sections of Castro Ranch Road, and San Pablo Dam Road need to be checked to determine what structural improvements may be needed to carry the proposed construction traffic, and what repairs may be needed afterwards.

LOS VAQUEROS

Vasco Road is located within the pool area of the reservoir project area. It also passes through the damsite. At some point prior to construction of a dam, Vasco Road would

have to be relocated, and a portion of the existing roadway closed to public access. Due to the importance of the road to area traffic flows, Vasco Road would remain in continuous operation without loss of service.

During construction there would be a substantial increase in the amount of traffic along Vasco Road, Marsh Creek Road, Camino Diablo Road, and possibly Deer Valley Road. Construction-related traffic would include construction workers commuting to the site, heavy equipment used in construction, and large trucks bringing in construction materials.

5.6.3 MITIGATION MEASURES

BUCKHORN PROJECT

The traffic generated by the proposed project is not anticipated to result in any significant long-term traffic impacts. Construction impacts during the short-term, however, could be significant. The following traffic mitigations are suggested to mitigate the effects of project construction:

- Further study should be made of the potential peak hour congestion impacts of construction traffic on Redwood Road at Castro Valley Boulevard and on Castro Valley Boulevard itself. If this is determined to be a significant impact, possible mitigation might include scheduling of construction shift changes and truck deliveries to avoid morning and evening peak hour conflicts.

- The load carrying capacities of Redwood Road, Camino Pablo, and other roads and bridges of concern to public agencies should be measured and reviewed for adequacy to carry the proposed construction loads. If necessary, lower capacity haul trucks might be used.

- Pipeline laying in public streets should be scheduled to avoid impairing school access during the school year, and should avoid peak hour closures. Street and driveway closures should be minimized. Adequate signing and traffic control personnel should be provided during street work.

- The project contractor should be responsible for repairing any damage to paving, fencing, and landscaping on public roads during and after construction.

- Public access and parking for the Chabot trailhead on Miller Creek Road should be maintained as much as possible.

- Construction traffic should be scheduled to avoid late evening and early morning hours on residential streets.

- o Alternative construction access roads and routes should be investigated to determine if impacts to the residential portions of Redwood Road and Camino Pablo can be avoided. One possibility for reducing the impacts to Camino Pablo would be to explore the feasibility of using the Miller Creek Staging area for accessing the King Canyon site as well. Another possibility might be to construct a direct access to Canyon Road south of Camino Pablo. Avoiding impacting Redwood Road would be much more difficult. One option might be to build a construction access road to Cull Canyon Road or even further to Crow Canyon Road. But this option would involve significant cost and environmental impacts that could be greater than the current access proposal.

- o Up-to-date daily and peak hour traffic counts should be made on Camino Pablo, Redwood Road, Canyon Road, Moraga Road, and St. Mary's Road to more precisely determine the extent of impact of the proposed construction traffic on these roads.

- o The need for additional traffic controls and warning signs at the intersection of Miller Creek Road and Redwood Road should be evaluated in light of the tight curve, the reduced sight distance, and the added construction traffic using Miller Creek Road.

- o Pipeline construction along Camino Pablo, Moraga and St. Mary's Roads would require additional project specific traffic control measures to assure that nearby residents and private and public facilities are not unduly inconvenienced.

- o Worker commute trips could be reduced by carpooling or vanpooling.

PINOLE PROJECT

The traffic generated by the proposed project is not anticipated to result in any significant long-term traffic impacts. Construction impacts however could be significant. The following traffic mitigations are suggested to mitigate the effects of project construction:

- o Further study should be made of the potential peak hour congestion impacts of construction traffic on Pinole Valley Road within the City of Pinole, and particularly at the I-80 freeway interchange. The intersection of San Pablo Dam Road at Appian Way and within the El Sobrante commercial district should also be studied. If congestion is determined to be a significant impact, possible mitigation might include scheduling of construction shift changes and truck deliveries to avoid morning and evening peak hour conflicts.

- o Construction traffic should be scheduled to avoid late evening and early morning hours on residential streets.

- o Pipeline laying in public streets should be scheduled to avoid impairing school access during the school year, and should avoid peak hour closures. Street and driveway closures should be minimized. Adequate signing and traffic control personnel should be provided during street work.

- The load carrying capacities of Pinole Valley Road, Castro Ranch Road, and San Pablo Dam Road should be measured and reviewed for adequacy to carry the proposed construction loads. If necessary, lower capacity haul trucks might be used.

- The project contractor should be responsible for repairing any damage to paving, fencing, and landscaping on public roads during and after construction.

- The realigned Pinole Valley, Alhambra Valley and Castro Ranch Roads should be constructed prior to closure of the existing alignments through the reservoir site to minimize traffic disruption.

- The west end of the realigned Pinole Valley Road should be tied into the existing Pinole Valley Road if possible, rather than connecting to an existing low volume residential street like Wright or Doidge Avenues.

- Consideration should be given to tying the east end of the realigned Alhambra Valley Road directly to the intersection of Bear Creek road and Hampton Road rather than offsetting the end point of the new road a few hundred ft. from this intersection.

- Additional up-to-date daily and peak hour traffic counts should be made on Pinole Valley Road and San Pablo Dam Road to better determine the impacts of construction traffic on these roads.

- The need for a temporary or permanent traffic signal at the intersection of Castro Ranch Road and San Pablo Road should be determined in light of the added construction truck traffic at this intersection. The need for additional traffic controls at Olinda Drive and Castro Ranch Road should also be evaluated in light of the proximity of this intersection to the Olinda School.

- Worker commute trips could be reduced by carpooling or vanpooling.

LOS VAQUEROS

Specific traffic mitigation measures were not identified for the Los Vaqueros project, however, specific control measures would be developed if the alternative were to be implemented.

5.7 NOISE

5.7.1 BACKGROUND

Environmental noise is measured in decibels (dB). The A-weighted decibel (dBA), refers to a scale of noise measurement which approximates the range of sensitivity of the human ear to sounds of different frequencies. On this scale, the normal range of human hearing extends from about 3 dBA to about 140 dBA. A 10 dBA increase in the level of a continuous noise represents a perceived doubling of loudness; a 2 dBA increase is barely noticeable to most people.

Human response to noise is subjective, and varies considerably from individual to individual. The effects of noise can range from interference with sleep, concentration, and communication, to physiological and psychological stress, and, at the highest levels, to hearing loss. The sound level of speech is typically about 60 to 65 dBA. Sleep disturbance commonly occurs when interior noise levels exceed 40 to 50 dBA.

Environmental noise fluctuates in intensity over time and several descriptors of time-averaged noise levels are in use. The three most commonly used are Leq, Ldn, and CNEL. Leq, the energy equivalent noise level, is a measure of the average energy content (intensity) of noise over any given period of time. Ldn, the day-night average noise level, is the 24-hour average of the noise intensity, with a 10 dBA "penalty" added for nighttime noise (10:00 PM to 7:00 AM) to account for the greater sensitivity to noise during this period. CNEL, the community equivalent noise level, is similar to Ldn, but adds an additional 5 dBA penalty to evening noise (7:00 PM to 10:00 PM). In situations where vehicles are the dominant source of noise, Leq for the peak commute hour, Ldn and CNEL of the same noise source usually differ by less than 2 dBA.

5.7.2 SETTING

BUCKHORN SITE

A proposed Buckhorn Terminal Reservoir project would affect noise levels at the dam site and along the access road used by construction traffic. A new access road will be an extension of Miller Road from the intersection with Redwood Road, past the construction staging area located just below San Leandro Dam and thence along the present Kaiser Creek and Big Burn fireroad alignments to the proposed dam site.

Ambient noise levels within the San Leandro Valley between Skyline Boulevard and Rocky Ridge are low, reflecting the valley's undeveloped character. The upper valley lies within the southern half of the District's East Bay holdings extending from Moraga on the north to Castro Valley in the south. There is very limited recreational use within the upper valley with exception of several hiking trails (e.g., King Canyon Loop, Rocky Ridge and Rampage Peak trails). Most recreational activity is centered outside the valley in Chabot and Redwood Parks (adjacent valleys to the west) and Las Trampas Regional Park to the east. The principal noise source in the upper valley is the low level of traffic along Redwood Road. Traffic volumes on Redwood Road range from 1,000 to 5,000 vehicle trips daily with the heavier volumes occurring on weekends and holidays.

Ambient noise levels at the Buckhorn Dam site itself are even lower than in the upper valley and are dominated by natural background noise such as wind in trees, wildlife and other sounds commonly prevailing in open rangeland. Noise levels are raised somewhat by over-flying aircraft and the passing of occasional maintenance vehicles. Although noise measurements have not been taken at the site, typical noise levels are in the range of 30 to 50 dBA.

The noise element of the Alameda County General Plan does not provide any specific guidance for acceptable noise levels in rural recreation areas. It does quote information from the U.S. Environmental Protection Agency that suggests an Ldn of 55 dBA as the maximum noise level in outdoor areas in which "quiet" is the basis for use.

PINOLE SITE

The proposed Pinole Terminal Reservoir project would affect noise levels at the site and near access roads used by construction traffic. Access roads would include both Castro Ranch Road and Pinole Valley Roads.

Ambient noise levels within the Pinole River Valley are low, reflecting the valley's undeveloped nature. The valley lies within the northern half of the District's East Bay holdings and is used primarily for range management purposes. The principal noise source in the valley is vehicular traffic along Pinole Valley Road. Traffic volumes range from 2,000 to 6,000 vehicle trips daily with heavier volumes occurring during the work week.

Ambient noise levels at a distance from the road are dominated by background sounds such as wind, wildlife and cattle movement. Noise levels can be raised somewhat by overflying aircraft. Although noise measurements have not been taken at the site, typical levels are in the range of 30 to 50 dBA.

The noise element of the Contra Costa County General Plan does not provide any specific guidance for acceptable noise levels in rural areas. It does quote information from the U.S. Environmental Protection Agency that suggests an Ldn of 55 dBA as the maximum noise level in outdoor areas in which "quiet" is the basis for use.

LOS VAQUEROS

Noise analyzes prepared for the Los Vaqueros EIR focused on potential for impacts along Vasco Road. As traffic noise levels are dependent on vehicle speed, noise levels along segments of Vasco Road were calculated assuming a variety of traffic speeds. Based on current traffic volumes, noise levels over most of the project area were estimated to be 40-60 dB (CNEL). Noise levels along Vasco Road are somewhat higher (CNEL values up to 67 dB).

5.7.3 IMPACTS

Operation of a new terminal reservoir would not have a noticeable affect on present background noise levels. There would not be an anticipated increase in noise generation or ambient noise levels as a direct or indirect result of the proposed projects.

BUCKHORN PROJECT

Noise would be generated during construction at the Buckhorn site and along access roads. During the construction period from 120 to 240 haul vehicles a day would enter and leave the site via Redwood Road. In addition, commuting construction workers in light trucks or automobiles might generate another 100 round trips each day. While the number of vehicles involved may not appreciably alter average ambient noise levels, truck noise would be noticeable along Redwood Road.

Noise produced at the staging and dam construction sites itself would be considerably greater than present background levels. The two principal sources of noise would be construction equipment and explosive blasting. Figure 5-16 shows the noise levels that might be expected 50 ft. from various types of construction equipment. Dozers, front-end loaders, scrapers and trucks would be used to excavate upstream borrow material and convey it to the dam site. Crushed rock would be mixed with cement to produce concrete at the staging area batch plant. Concrete would be conveyed to the dam and dikes by truck for placement. The loudest continuous noise sources would be from the concrete batch plant operations. Noise studies conducted for similar dam construction projects indicate that the mix of equipment in use characteristically produces a maximum noise level between 70 and 75 dBA at 1,000 ft.

The other source of noise would be explosive blasting. Major blasting as practiced at rock quarries would not be necessary, but large boulders and outcrops within the borrow areas would be fractured with explosives. Boulder "popping" activity would not be expected to produce greater noise than other construction activities but the noise would be qualitatively different.

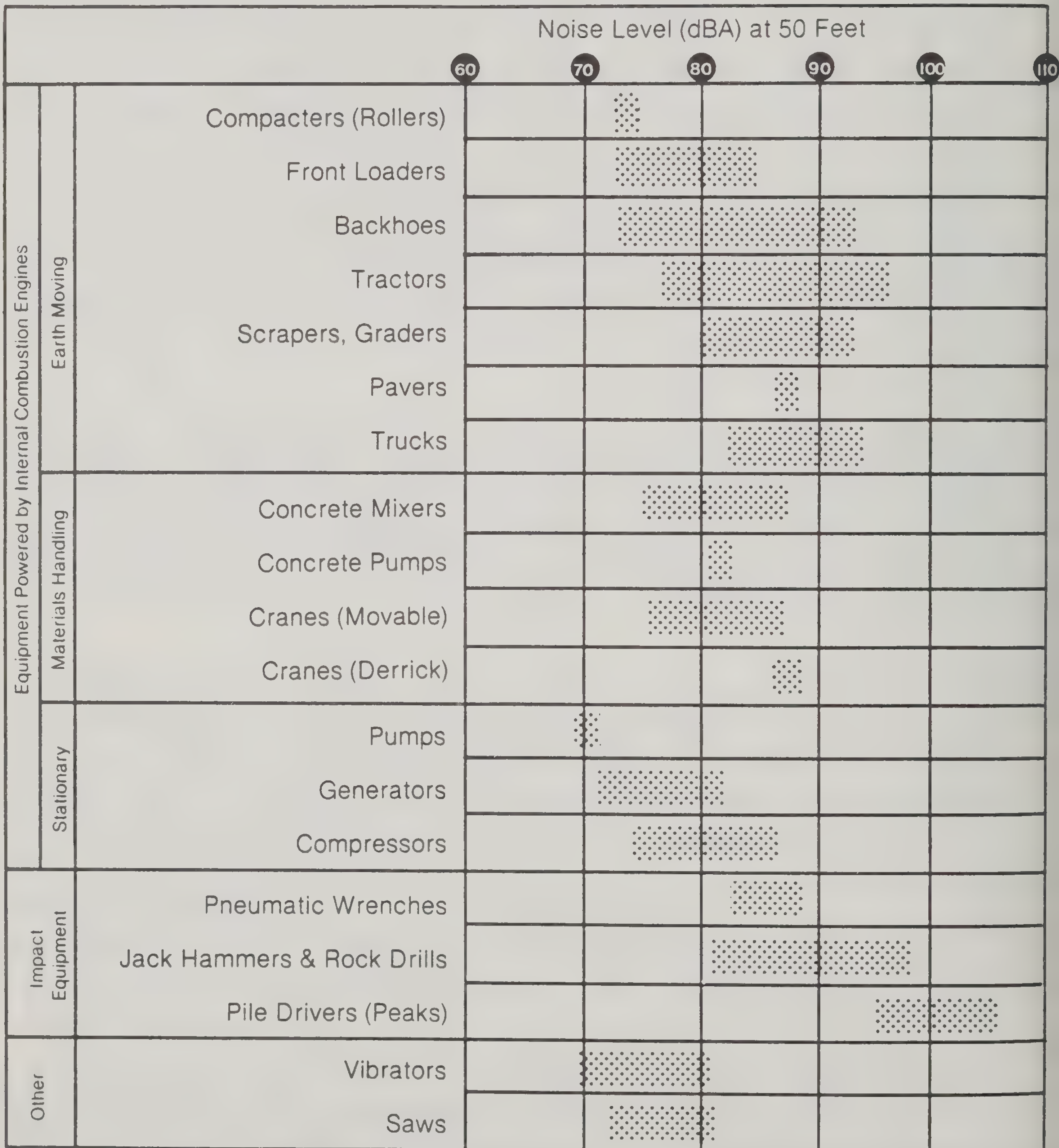
Although construction activities at the site would raise noise levels considerably the impact on users of the District's open lands would be slight because recreational use of the area near the dam is so limited and would most likely occur during weekends and holidays when construction activities have stopped. Use would be further restricted during construction. Most of the more popular hiking trails are miles from the site and separated from it by ridges. If construction activities are audible they would be perceived as distant rumble. Hikers using trails nearest the dam such as on Rocky Ridge Loop Trail, would be able to hear distant construction; their probable enjoyment of natural setting would be noticeably impaired.

PINOLE PROJECT

Noise would be generated during construction of Pinole Dam at the site and along the access roads. During dam construction some 40 to 80 trucks per day would enter and leave the site via either Castro Ranch Road or Pinole Valley Road. In addition, commuting construction workers in light trucks or automobiles would generate an

CONSTRUCTION EQUIPMENT NOISE LEVELS

FIGURE 5-16



NOTE: Base on limited available data samples.

SOURCE EPA PB 206717 ENVIRONMENTAL PROTECTION AGENCY.
DEC 31 1971 "NOISE FROM CONSTRUCTION EQUIPMENT & OPERATIONS"

additional 100 round trips each working day. While the number of vehicles involved is too small to appreciably alter average ambient noise levels, heavy equipment and haul truck noise would be noticeable to residential dwellers along both roads. This would be particularly true during the peak construction period when aggregate, cement and other building materials were being transported to the site. Some would find truck noise incompatible with their enjoyment of a the rural setting.

Noise produced at the construction site itself would be considerable. The two principal sources of noise would be mobile and stationary construction equipment and explosive blasting. Figure 5-16 shows the noise levels that might be expected 50 ft. from various types of construction equipment. Dozers, front-end loaders and trucks would be used to excavate and convey earthfill material. The loudest continuous noise source would be from a concrete batch plant located adjacent to the dam site. Studies at a staging area conducted for a similar dam construction project indicated that the mix of equipment in use could produce maximum noise levels between 70 and 75 dBA at 1,000 ft.

Another potential source of loud noise would be from explosive blasting. Major blasting as practiced at rock quarries would be unnecessary, but any bedrock uncovered at the dam site as well as large boulders may require fracturing with explosives. Boulder "popping" would not be expected to produce any greater noise than the other construction activities but the noise would be qualitatively different, being briefly carried a greater distance and perceived by the ear as an audible "report."

Construction activities at the site would raise noise levels considerably and some adverse impact on nearby residents would be evident. Audible construction related activities may be perceived above the level of road noise. Passive enjoyment of rural sounds would be noticeably impaired for those in the vicinity for several years during dam construction.

LOS VAQUEROS

Impacts

The proposed project would contribute several sources of noise to the project area. Construction activities would be a temporary noise source. The major long-term noise source would involve vehicle traffic related to the site.

Construction Noise. Construction equipment and activities typically generate noise levels of 85-90 dBA at 50 feet from the equipment. Off-site noise levels during project construction would vary considerably depending on the location of construction activities and the types of equipment in use. Construction noise levels near the project boundaries can be expected to vary from 55 to 80 dBA.

Due to the temporary nature of construction noise and lack of current development on neighboring properties, construction noise impacts were not considered significant.

Although noise levels are expected to increase slightly, if recreational use of the proposed reservoir occurred, projected noise levels are generally compatible with existing and proposed land uses. Therefore, the analysis indicates that noise levels resulting from management (recreational use) of the proposed project site would not be a significantly adverse impact.

Since noise levels under this option assume development of a reservoir, Vasco Road would be relocated under this condition. The expected noise levels would, therefore, occur along the relocated roadway. The location of this replacement facility is currently undefined.

5.7.4 PROPOSED MITIGATION MEASURES

A number of mitigation measures are suggested that would reduce noise impacts at any selected dam site during construction activities.

- Truck movements on all access roads could be limited to weekdays between 8:00 AM and 6:00 PM.
- Construction specifications could include a provision requiring adequate mufflers on trucks and other construction equipment.
- Nearby residents, in the case of the Pinole project, should be given advanced warning of blasting episodes.
- No work that would generate a noise level above the ambient background would be carried out from 10 PM to 6 AM, except tunneling work where the work site is enclosed, and for emergency work.

5.8 AIR QUALITY

5.8.1 SETTING

Meteorological Influences on Air Quality

A major factor determining ambient air pollutant levels is the atmosphere's ability to transport and dilute pollutants. Major determinants of transport and dilution are wind speed and direction, atmospheric stability, influence of terrain on air movement, and, for pollutants that are photochemically active, the amount of sunlight.

Data from local weather stations show that prevailing winds blow from west and north, reflecting dominance of high pressure cells centered over the northeastern Pacific Ocean, although channeling of airflow by local terrain often overrides this large-scale influence.

Occurrence of episodes of high atmospheric stability, known as inversion conditions, severely limits the ability of the atmosphere to disperse pollutants vertically. Atmospheric stability in the Bay Area is measured twice daily by radiosondes released from the Oakland Airport. In winter, inversions, caused by cooling of air close to the ground, can form in the evening and early morning hours but frequently dissipate during the day. During the summer, the inversion layer is thicker but is present about 90% of the time in both morning and afternoon.

The proposed project areas are located amidst sheltered, inland valleys ringed by hills which are higher than 1000 ft. in places. Atmospheric flows into the project area are accomplished through narrow gaps in the hills. This limits the ability of the atmosphere to disperse pollutants horizontally.

Air Pollutant Problems and Trends

The 1970 Clean Air Act Amendments established federal ambient air quality standards (AAQS) for several pollutants. The Act outlined primary standards designed to protect public health and secondary standards to protect public welfare from effects such as visibility reduction, soiling, nuisance, and other forms of damage. The AAQS were designed to protect those people most susceptible to respiratory distress, such as asthmatics, the elderly, very young children, people already weakened by illness, and

persons engaged in strenuous work or exercise (all termed "sensitive receptors"). AAQS were established in California starting in 1969 pursuant to the Mulford-Carrell Act. The State and federal AAQS given in Table 5-4 provide acceptable durations for specific contaminant levels. Federal standards are supposed to be attained by 1987 and maintained thereafter; the State standards do not have a specific attainment date.

The Bay Area Air Quality Management District (BAAQMD) operates a regional air quality monitoring network in order to gauge the Bay Area's progress toward attainment of federal and state ambient air quality standards. At monitoring stations throughout this network, readings are taken regularly of five major "criteria" air pollutants: photochemical oxidants (ozone), carbon monoxide (CO), suspended particulate matter (TSP), nitrogen dioxide (NO2), and sulfur dioxide (SO2). On the basis of this monitoring data, the California Air Resources Board (CARB) has designated the Bay Area a non-attainment area with respect to the national ozone and CO standards.

A three-year summary of the data collected at three stations located in areas peripheral to the sites proposed for reservoir construction is shown in Table 5-6 along with the corresponding federal or State AAQS. There are no stations in the East Bay hills. The data in Table 5-6 indicate that air quality in the northeast Bay Area is not in compliance with federal and state ozone standards. Air quality does comply with standards for CO, NO2, SO2, and TSP. Because elevated ozone levels are a regional problem and because ozone is more of a problem in the warmer interior portions of the Bay Area, concentrations in the project area are likely to be between the values measured near the East Bay shore (i.e., at Richmond and Oakland) and those measured further inland at Concord. In contrast, levels of pollutants such as CO and TSP are more sensitive to nearby sources; the tabulated data, therefore, may not adequately represent conditions in the project vicinity.

Regionally, the most severe and complex air quality problem is the relatively high level of ambient ozone experienced during warm, meteorologically stable periods in the summer and autumn. Ozone is not emitted directly from pollutant sources but forms in the atmosphere through a complex series of photochemical reactions involving reactive organic compounds (ROG) and nitrogen oxides (NO_x). No single source category accounts

TABLE 5-6

AIR POLLUTANT DATA SUMMARY 1984-1986

STATIONS: Richmond (RCHM), Concord (CNCD), Oakland (OAKL)

	1984			1985			1986		
Pollutant	RCHM	CNCD	OAKL	RCHM	CNCD	OAKL	RCHM	CNCD	OAKL
OZONE									
Highest 1-hour	0.09	0.14	0.11	0.09	0.15	0.12	0.07	0.12	0.09
Days > 0.12 ppm[1]	0	3	0	0	1	0	0	0	0
CARBON MONOXIDE									
Highest 8-hour	4.8	5.9	8.0	4.3	5.3	5.8	5.0	5.6	7.5
Days > 9.0 ppm[1]	0	0	0	0	0	0	0	0	0
NITROGEN DIOXIDE									
Highest 1-hour	0.13	0.10	N/A	0.11	0.10	N/A	0.13	0.11	N/A
Days > 0.25 ppm[1]	0	0	N/A	0	0	N/A	0	0	N/A
SULFUR DIOXIDE									
Highest 24-hour	13.0	11.0	N/A	11.0	17.0	N/A	13.0	8.0	N/A
Days > 50 ppb[2]	0	0	N/A	0	0	N/A	0	0	N/A
PARTICULATES									
Annual Average[3]	56	46	N/A	53	43	N/A	38	39	N/A
Year > 60 μg/m^3 [3]	No	No	N/A	No	No	N/A	No	No	N/A
Days > 150 μg/m^3 [3]	0	0	N/A	0	0	N/A	0	0	N/A

[1] ppm: parts per million

[2] ppb: parts per billion

[3] μg/m^3: micrograms per cubic meter

Source: BAAQMD, Air Currents, March issues, 1983-1985.

for a majority of the ROG and NO_X emissions, and the many sources are spread throughout the Bay Area air basin. Although the Bay Area's highest ozone levels can fluctuate from year to year, standards are exceeded most often in the Santa Clara, Livermore, and Diablo valleys.

In contrast to ozone, CO is a sub-regional problem in the Bay Area. CO is a non-reactive pollutant with one major source, motor vehicles. Ambient CO distributions closely follow the spatial and temporal distributions of vehicular traffic, and are strongly influenced by meteorological factors such as wind speed and atmospheric stability. The one-hour and eight-hour CO standards are occasionally exceeded in those parts of the Bay Area subject to a combination of high traffic volumes and frequent atmospheric inversions during the winter months (i.e., northern Santa Clara, western Alameda, and southwestern Solano Counties). Because of the low population density in the project area, CO levels should be significantly lower in the project area than at any of the three monitoring stations.

Levels of TSP in the Bay Area typically show a pattern of low values near the coast. They increase with distance inland and reach their highest levels in dry, sheltered valleys, such as the Santa Clara, Diablo, and Livermore Valleys. The federal standard is occasionally exceeded in many Bay Area communities. The most important particulate sources in the Bay Area are demolition and construction activity, and motor vehicle travel over paved and unpaved roads. Much of the dust generated from such sources is comprised of large particles that settle out rapidly, and most of the remaining fraction are easily filtered by human breathing passages. To reflect this understanding, the State of California has recently changed its standard for particulate matter to include only respirable particles less than 10 microns in diameter. Dust generated by vehicles and construction is, therefore, of concern more as a soiling nuisance rather than for its unhealthful impacts. TSP levels in the project area are probably slightly lower than those at the Concord monitoring station.

The major sources of NO_X, compounds that have an important role in the formation of ozone, are vehicular, residential, and commercial fuel combustion. Concentrations of NO2, the most abundant form of ambient NO_X, are highest in the South Bay (where the standard was last exceeded in 1980 at the San Jose monitoring station), although a

secondary peak is centered on the Livermore valley. The NO2 standard has not been exceeded anywhere in the Bay Area since 1980.

The burning of high sulfur fuels for activities such as electricity generation, petroleum refining, and shipping are major sources of ambient SO2. The highest levels of SO2 are recorded by monitoring stations located in a relatively narrow crescent centered on the bayshore of northern Contra Costa County, where the major sources are located. Bay Area seasonal maximums, however, rarely exceed 50% of the standard and SO2 levels at most Bay Area monitoring stations are less than 10% of the standard. The SO2 standard is currently being met throughout the Bay Area.

As a result of violations of CO and ozone standards in the region, the BAAQMD, the Association of Bay Area Governments (ABAG), and the Metropolitan Transportation Commission (MTC) authored the 1982 Bay Area Air Quality Maintenance Plan (AQMP). The AQMP called for the imposition of additional controls on stationary and mobile sources of ROG and CO, and set forth a schedule for adopting and implementing these controls. If these control measures are successful, national ambient standards for all five criteria pollutants discussed above should be met by 1987 and maintained below the standards through the year 2000. The key CO strategies in the AQMP include a motor vehicle inspection/maintenance (I&M) program. In 1984 the State of California adopted a mandatory I&M program that is expected to reduce CO in the Bay Area by 16%. No additional control measures were recommended for TSP control. This problem is difficult to control with currently available methods, and the BAAQMD only recommended further research on the problem.

The Los Vaqueros/Kellogg study area lies within the foothills area of southeastern Contra Costa County on the eastern slope of the Coast Ranges. Prevailing wind direction is from the northwest, resulting from marine breezes through the Carquinez Strait. During winter, the sea breezes diminish.

Between late spring and early fall, cool air from the Delta and San Francisco Bay is frequently overlain by warm air resulting in an inversion. Inversion phenomena tend to adversely affect air quality. Typical winter inversions are formed by heating of the upper

air by the sun's radiation, which traps air below that has been cooled by being in contact with the colder surface of the earth during the night. However, both types of inversions can occur at any time of the year. Inversions vary widely in the area during the year and can even change during a day. Local topography produces many variations which can affect the inversion base and thus influence local air quality.

5.8.2 POTENTIAL IMPACTS

BUCKHORN SITE

Operation of the proposed Buckhorn Reservoir would not be expected to have any effect on regional climatic conditions. However, the local climate in the vicinity of the proposed reservoir may be altered slightly. The local effects stem from the fact that the large body of water would exert a moderating influence on temperature. During hot summer days, the mass of cool water in the reservoir would lower the air temperature above it. On cold winter nights, the water mass would warm the air. Studies at other reservoirs suggest that the moderating influence would result in air temperatures downwind of the reservoir less than 1^{o} F different from upwind air temperatures most of the time, although the temperature difference could be as much as 5^{o} F under extreme circumstances.[2] The humidity of air passing over the reservoir surface may also be increased slightly. It is unlikely that the humidity rise would be sufficient to increase the frequency of fog. Operation of the proposed project would have no discernible impact on local or regional air quality.

The principal air quality impact resulting from project construction would be an increase in total suspended particulate (TSP) matter for the duration of construction activities. These dusts would be produced as a result of concrete, excavation and earthmoving operations, loading and unloading of materials at the borrow and dam sites, and by the movement of construction vehicles over paved and unpaved surfaces. Although state and federal air quality standards would likely be violated in the vicinity of the construction site, it is difficult to accurately predict the TSP concentrations that would occur on-site because of the complexity of meteorological and topographic conditions, variations in soil silt and moisture content, and the difficulty in estimating exact source strengths.

Those particulates that would be emitted would be considered primary particulates, as opposed to secondary particulates. Primary particulates are produced as a direct result of physical grinding and other processes, and tend to be rather "large" sized particles, generally greater than 30 microns. Their size and density causes them to settle out of the atmosphere rather rapidly, and they are effectively filtered out by human breathing passages. Secondary particulates, on the other hand, are produced by subsequent chemical reactions in the atmosphere, are usually smaller in size (less than 10 microns), and are more likely to become imbedded in the human lung.

Although substantial quantities of dust are likely to be generated at the construction site, these impacts are not expected to be significant at distances of more than a few thousand feet from the site itself. Therefore, the overall impact is considered to be not significant.

Use of fossil fuels in the internal combustion engine produces a variety of pollutants. Operation of diesel engines produces carbon monoxide, hydrocarbons, oxides of nitrogen, and secondary particulate matter. These emissions would occur both on the construction site and along access roads as trucks hauled in equipment and supplies. Automobiles would be used to transport workers to and from the construction site, and this would generate emissions of carbon monoxide, hydrocarbons and oxides of nitrogen.

Although this would contribute to the overall quantity of motor vehicle emissions, the effects are temporary, lasting only for the duration of construction, and therefore are viewed as being not significant.

Brush and other vegetation would have to be cleared before the reservoir is filled. If brush is disposed of by burning, significant impacts on air quality could occur.

PINOLE SITE

The operational effects of the Pinole Reservoir on climate and air quality would be the same as those described for the Buckhorn Reservoir.

The impacts of construction of the Pinole Reservoir would be, in general terms, similar to those described for the Buckhorn Reservoir. The difference would be in the extent of the impacts. Because the Pinole Dam would be much smaller than the Buckhorn Dam, the work crew and the amount of heavy equipment operated for the Pinole Dam construction would be about one-third that of the Buckhorn Dam construction. Thus the air quality impacts would be expected to be about one-third of those of the Buckhorn Dam construction.

LOS VAQUEROS

Construction of the proposed project would cause an indeterminable quantity of dust particles to be emitted into the atmosphere. A major fraction of these dust particles would settle out immediately adjacent to and on the proposed project site, while a minor fraction would contribute to the area's ambient particulate level. In general, particles larger than 30 microns (effective aerodynamic diameter) would settle out within a short distance of the roadway. Construction equipment with internal combustion engines would emit an indeterminable quantity of NO_x, HC, particulates, sulfur dioxides, and CO. These impacts were considered to be less than significant.

5.8.3 SUGGESTED MITIGATION MEASURES

The following measures are suggested to mitigate construction-related impacts.

- Watering of exposed earth surfaces can reduce dust emissions by approximately 50% when done twice daily; frequencies should increase if wind speeds exceed 15 mph.
- Access roads should be paved or oiled to reduce dust generation.
- Haul trucks should use tarpaulins or other effective covers.
- Vehicles and machinery should be turned off when not in direct use in order to reduce tailpipe emissions.
- All vehicles should be properly maintained, and pollution control equipment should be inspected periodically.
- Carpooling, vanpooling, on-site trailer camps for workers or other measures that would reduce project-generated motor vehicle travel would produce minor air quality benefits.
- Use of electrical power (instead of fossil fuel power) as much as possible.
- Cleared brush and lumber should be trucked away for disposal.

Standard construction practices would greatly reduce the amount of dust particles emitted during construction. These measures include minimizing the amount of time surfaces are left exposed, periodic sprinkling of exposed areas and soil piles with water, and covering soil piles with plastic sheets or tarpaulins to limit disturbance.

Vehicles traveling on exposed surfaces should not be driven at excessive speed. Preparation of roadway surfaces in a stepwise fashion, where segments of the route are graded in succession, would greatly minimize the amount of time the surfaces are left exposed, thereby reducing these emissions. Also, proper maintenance of construction equipment would minimize emissions from internal combustion engines.

As the impacts related to reservoir operation are judged to be insignificant, no additional mitigations are suggested.

5.9 CULTURAL RESOURCES

5.9.1 INTRODUCTION

Cultural resources, including archaeological, historic and ethnographic sites, are non-renewable resources with scientific, humanistic and social values. These values are recognized and protected by a variety of federal and state laws and regulations. Specifically applicable to a proposed new terminal reservoir located in the hills of the East Bay are:

1. The National Historic Preservation Act (NHPA) -- establishes historic preservation as a national policy and required that federal agencies identify project effects on significant cultural resources and consider prudent and feasible measures to avoid or mitigate adverse effects.

2. Archaeological Resources Protection Act -- regulates removal of artifacts from public lands.

3. National Environmental Policy Act -- regulates the identification of impacts to significant sites.

4. 36 CFR 800 -- implements Section 106 of the NHPA and established procedures for federal agency consultation with the State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (ACHP).

5. American Indian Religious Freedom Act -- enjoins federal agencies from taking action that would preclude the free exercise of Native American religions.

6. California Environmental Quality Act -- requires state agencies to identify impacts to important cultural resources.

Compliance with this body of public policy requires identification of resources likely to be affected by any dam construction project, evaluation of the significance of these resources and development of a treatment plan for significant resources in consultation with the SHPO and ACHP. This section of the report provides guidance in fulfilling federal and state cultural resource requirements.

The construction of a proposed additional terminal reservoir in the East Bay has the potential to affect archaeological resources. Pursuant to CEQA and NEPA guidelines, a series of cultural resource surveys have been conducted and inventory reports prepared for this EIR document. The inventory reports are on file with the District. This chapter summarizes the findings of the inventory reports.

It was determined that both Class I and II surveys were needed for new dam facilities proposed in the terminal reservoir element of the program. The levels of survey are defined as follows:

Class I Survey

A Class I survey is basically a literature/archival search. It consists of consulting the National Register of Historic Places and supplemental National Register listings to determine whether or not any National Register eligible/listed properties exist within the area of concern. It also includes contacting the SHPO, State Archaeologist, State Historian, State Historical Society and/or other appropriate individuals, agencies or institutions to determine what cultural resources may be present in the area and what kind of additional information may be needed for an adequate inventory of cultural resources. Regional records are also examined for potentially eligible properties for listing on the National Register of Historic Places.

Class II Survey

The goal of a Class II survey is evaluation of cultural resources based on a sample which can serve as an indicator of resources present in the entire area to be affected. This type of survey is normally an "on-the-ground" examination of a statistically valid sample of the total study area but can include remote sensing and/or geomorphological investigations or other appropriate techniques. Class II surveys are designed to aid in determining the necessity for a Class III survey and may be combined with a Class I survey or bypassed in favor of a Class III survey.

Primary objectives of the literature search and archaeological surface reconnaissance are twofold: 1) to locate, identify and, to the greatest extent possible, evaluate those cultural resources of demonstrated or potential significance found to exist on the surface of the ground within the confines of the project areas; and 2) to propose appropriate recommendations for any additional archaeological procedures deemed necessary to further investigate and/or mitigate adverse impacts to any such cultural resources identified.

5.9.2 SETTING

BUCKHORN SITE

Reservoir Inundation Zone

A historical overview of the reservoir site and vicinity was made as part of the archaeological assessment effort. During prehistoric times (ca. 6000 BC - 1770 AD), the entire East Bay region comprised a portion of the expansive Native American territory of the Costanoan tribal group. The site itself formed a small corner of the vast Peralta family holdings (i.e., Rancho San Antonio) during the first half of the 19th Century but was subsequently under various ownership until acquired by the District in the 1920s in its yet undeveloped state. A historical account of the region and site is incorporated in Appendix D.II of this report.

Present usage of the proposed Buckhorn Reservoir is primarily devoted to cattle grazing. Only minimal alteration to the natural landscape was noted during the course of the on-site archaeological reconnaissance: a series of dirt roads, used as fire trails, criss-cross the area. In addition, a single barn with attendant corrals was observed. Other sources of topographic disturbance include power lines, cattle trails and wallows.

Borrow Sites located along Kaiser Creek

These proposed sites, consisting of three localized zones each of approximately 20 acres, range in elevation from 800 to 1,000 ft. above mean sea level (msl). In the vicinity of the three potential borrow sites, Kaiser Creek itself lies at an approximate elevation of 600 ft. msl. Each of the borrow sites is situated on the top of a steep-sided ridge, covered with low-lying introduced grasses -- including bunch grasses, brome grasses, needle grass and assorted forbs and thistles. Thick stands of Coast live oak as well as locally occurring buckeye and California bay laurel were observed in the immediate area. Poison oak and scrub oak abound in the form of dense thickets.

The dominant geology in this portion of the project area consists of light brown sandy soil overlain by a darker sandy topsoil. This latter soil averages some six inches in depth. Intermittent, heavily weathered sandstone outcrops occur throughout the area. This

portion of the proposed Buckhorn Reservoir project site is currently used as a cattle pasture. No significant alteration or disturbance to the natural topography was observed during the course of on-site archaeological reconnaissance.

King Canyon Tunnel Structure

This part of the project area, situated close to half a mile to the west of the western boundary of the proposed Buckhorn Reservoir inundation zone, lies between 520 and 560 ft. msl in fairly broad canyon drainage. The area has been markedly disturbed by an improved gravel road, a jeep trail, paved road, a horse corral with associated structures and a Christmas tree farm. As a result of these alterations to the natural topography, surface visibility was generally excellent in this portion of the project area.

Throughout this part of the subject area, native vegetation consists of thickets of thistle, low-lying introduced grasses and marsh species above the proposed level of inundation. Confined to the King Canyon drainage proper are riparian species including willow, tule and other rushes, poison oak and scattered Coast live oak.

Access Roads and Staging Area

The proposed spillway abuts Upper San Leandro Reservoir at an elevation of 480 ft. msl. Vegetation is much like that described above, including low-lying introduced grasses, dense thickets of chaparral, Coast live oak and poison oak. Dominant site geology is basically the same as that described above. No significant alterations to the natural topography were noted in the immediate vicinity of the proposed spillway.

The access roads range in elevation from approximately 320 ft. msl at the southern extension to over 800 ft. msl near the crest of Big Burn Road. Terrain is consistently steep throughout this area.

Vegetation ranges from low-lying grasses to dense thickets of chaparral including Coast live oak, scrub oak, poison oak, manzanita and a variety of shrubs. Dominant geology within this portion of the project site is as described above, with a markedly greater frequency of sandstone bedrock outcrops.

Archaeological Resources in the Vicinity of Buckhorn

Before archaeological surface reconnaissance of the proposed Buckhorn Reservoir inundation zone was undertaken, maps and other archival documents relating to previous archaeological research in the vicinity of the project area were consulted. This documentary research was conducted at the Northwest Information Center, located on the Campus of Sonoma State University in Rohnert Park, California.

The project area is situated in territory which, at the beginning of the historic period, was occupied by the Costanoan, or, as they are often referred to in the Anthropological literature, Ohlone people (see Key to Tribal Territories Map" in Heizer 1978: ix). Ethnographic and archaeological summaries of the Costanoans can be found in the following sources: The Handbook of North American Indians, Volume 8 (see Levy 1978:487-495), the Handbook of California Indians (Kroeber 1925:462-473), California Archaeology (Moratto 1984), The Archaeology of California (Chartkoff and Chartkoff 1984) and The Ohlone Way: Indian Life in the San Francisco - Monterey Bay Area (Margolin 1978).

Archival research revealed that no archaeological sites of either prehistoric or historic period age or character have been recorded within the confines of the proposed Buckhorn Reservoir inundation area, nor have any archaeological sites been recorded within a one mile radius of the area. However, it should be noted that the area has never been the subject of formal archaeological scrutiny; it is, therefore, quite possible that the lack of recorded cultural resources within the proposed 1,100-acre inundation zone can be attributed to the lack of formal research rather than to a demonstrable paucity of archaeological sites or associated materials.

A look at the USGS topographic map (Las Trampas Ridge, 7.5') which includes the proposed Buckhorn Reservoir and surrounding vicinity indicated that the area was well suited for the existence of archaeological sites. Based on findings and observations of the literature search describing environmental setting in the immediate vicinity of the proposed inundation zone, it was determined that there was reasonable possibility for discovery of potentially significant cultural resources within the confines of the subject property. Hence, an on-site archaeological surface reconnaissance was deemed appropriate.

Buckhorn Field Reconnaissance

Between April 20-24, 1987, on-site reconnaissance of the proposed Buckhorn Reservoir was undertaken. The surface survey was conducted by five members of the Archeo-Tec consulting team. The entire inundation area was systematically criss-crossed in a series of 60-100 ft. transects in an attempt to locate and identify cultural resources. All topographic features that are commonly known to contain archaeological materials, i.e., knoll and ridge tops, areas adjacent to stream courses, or bedrock outcroppings, were noted and investigated by the survey team. At the time field reconnaissance was conducted, much of the project area was covered with a thick growth of vegetation (in the form of weeds, low grasses and riparian foliage) which in places hindered accurate visual inspection of ground surface. The team had to rely heavily on disturbed areas, such as rodent backdirt, cattle trails and wallows, dirt roads and cut stream banks, to observe actual ground surface.

On-site surface reconnaissance encountered two distinct archaeological sites within the subject property -- one of historic period age and characteristics, and another adjacent site of prehistoric and/or proto-historic affinities. As described below, although these two sites have been recorded as separate cultural entities, it is possible that they could be temporally and/or functionally related.

In addition to the two archaeological sites described above, two isolated prehistoric artifacts were encountered in close proximity to one another within the proposed inundation zone. The presence of these two cultural isolates may indicate the presence of another archaeological site, or sites, in the immediate area where the isolate was encountered.

Site CA-Ala-481 is located along Kaiser Creek and Kaiser Creek Road. As observable from archaeological surface manifestations, the site is characterized by four bedrock mortar features, consisting of two sandstone boulders, each with a single cup, situated on the west side of Kaiser Creek, and two other sandstone boulders respectively featuring two mortar cups and a grinding slick within the Kaiser Creek channel. In addition to the

four bedrock mortar features, one definite pecked rock art element was recorded on a sandstone boulder on the east side of Kaiser Creek, as well as several possible grooved elements on the west side.

Site CA-Ala-482H is an historic period archaeological site consisting of a single-course stone foundation fabricated of locally available sandstone forming a rectangle with a south facing entrance. Two adjacent depressions may represent the remnants of out-buildings and/or trash pits. A variety of historic period artifacts were observed in close proximity to these architectural features, including a metal stove part, several rusted metal pipes, white "ironstone" ceramic fragments, and numerous shattered glass bottles. One glass bottle base was embossed with a registration date of 1882 (Godden 1964).

As noted, archaeological sites CA-Ala-481 and 482H were found in close physical proximity to one another, and the possibility that these two sites may be either temporally and/or functionally associated has not been ruled out on the basis of evidence presently available.

Cultural isolate HBR-A is a complete, bifacially worked, leaf-shaped obsidian projectile point found in the rut of a dirt road in Buckhorn Canyon within the northernmost part of the project area. The dimensions of this artifact are two inches in length, less than one inch in maximum width and one-half inch in maximum thickness. The object weighs approximately 0.3 of an ounce. One edge of the specimen has been bifacially nicked and crushed. The artifact was examined in the field but not collected.

Cultural isolate HBR-B is a complete bifacially worked, laceolate obsidian projectile point with a broken tip found approximately 300 ft. to the east of cultural isolate HBR-A. The dimensions of this artifact are approximately two inches in length, less than one inch in maximum width and one-half inch in thickness. The object weighs approximately one-half ounce. As with HBR-A, the artifact was examined but not collected. Color slides of both of these artifacts are on file in Archeo-Tec's archives.

In spite of an intensive search of the ground surface, no other artifacts, anthropic soils or other possible indicators of prehistoric cultural resources were noted in the immediate

vicinity of the two cultural isolates. However, as floral covering was extremely heavy in and around these isolates, it is possible that other related cultural resources remain undetected on or beneath the ground surface.

No other archaeological sites, isolated artifacts or anthropic soils were encountered during the course of on-site reconnaissance within the proposed inundation zone. As noted, heavy ground cover throughout the area hindered accurate visual inspection, and it is possible that other cultural resources may exist at one or more points within the subject area.

On August 3, 1987, an additional on-site reconnaissance of proposed supplemental facilities was undertaken by the Archeo-Tec survey team. The areas projected for use as borrow sites, the proposed location of the spillway structure, the alignment of improvements to Big Burn and Kaiser Creek roads, the site of the construction staging area, and the planned site of the exit tunnel and blow-off structure at the mouth of King Canyon were criss-crossed in a series of 60 ft. transects in an attempt to locate and identify any additional cultural resources. All topographic features or other potential indicators of the presence of archaeological materials -- i.e., areas adjacent to stream courses and springs, rodent disturbance, cattle wallows or bedrock outcroppings -- were noted and investigated by the survey team.

No evidence of archaeological resources of either prehistoric or historic age or character were encountered anywhere within the confines of the supplemental subject areas. No isolated artifacts were encountered, nor were any anthropic soils observed. Therefore, on the basis of the evidence obtained through on-site reconnaissance, it is the judgement of the archaeological consultant that development within the supplemental portions of the proposed Buckhorn Reservoir Project will result in no direct impacts to cultural resources of demonstrated or potential significance.

However, it is likely that excavation within two of the three proposed "borrow sites" will result in possible indirect/secondary impacts to the nearby CA-Ala-481 and CA-482H. Recommendations concerning possible mitigation of these impacts are considered in the Section 5.9.4.

PINOLE SITE

General Location

A historical overview of the reservoir site and vicinity was made as part of the archaeological assessment effort. During prehistoric times (ca. 6000 BC - 1770 AD), the entire East Bay region comprised a portion of the expansive Native American territory of the Costanoan tribal group. Upper Pinole Creek was within the boundaries of Rancho Pinole, granted to Don Ignacio Martinez in 1823. The reservoir site remained undeveloped through subsequent purchase by the Tormey family in the mid-1860s, and the Fernandez family in the 1870s, and was ultimately acquired by the District in 1946. Alterations to the landscape in this vicinity have remained minimal. A historical account of the region and site is incorporated in Appendix DII of this report.

Present usage of the proposed Pinole Reservoir area is predominantly devoted to cattle grazing. The eastern half of the area, south of Pinole Creek Road, is currently used for cultivation of oats, wild wheat and vetch.

Moderate alteration to the original landscape has occurred in the recent past. South of Pinole Valley Road, the eastern portion has been subjected to intensive tilling and cultivation during the past several decades. Several residential structures, as well as a barn and stable, exist within this portion of the property; there is also a network of graded dirt roads. Yet within the eastern portion, the level of disturbance is less marked north of Pinole Valley Road; the several stables and dirt roads represent the only modification of the original landscape.

The northern portion of the proposed inundation area contains five marshy ponds, only one of which is noted on the USGS topographic map, (Briones Valley 7.5'). Earthen levees in the vicinity of these ponds suggest considerable localized disturbance to topsoil. A single aluminum barn, two large water tanks and a windmill were noted. Numerous dirt roads are scattered throughout the area. With exception of the above noted earthen levees, disturbance is minimal within this northern portion.

The western portion of the proposed inundation zone is the most pristine part of the subject property. However, south of Pinole Valley Road and east of Castro Ranch Road,

localized dumping of construction rubble, a residential structure, a graded dirt road and a Christmas tree farm have altered the original landscape to a degree.

Archaeological Resources in the Vicinity

Before archaeological surface reconnaissance of the proposed inundation zone was undertaken, maps and other archival documents relating to previous archaeological research in the vicinity were consulted. This research was conducted at the Northwest Information Center, located on the Campus of Sonoma State University in Rohnert Park, California.

The project area is situated near the northeastern border of the territory which, at the beginning of the historic period, was occupied by the Costanoan, or, as they are often referred to in the Anthropological literature, Ohlone people (see previous Buckhorn discussion for ethnographic references).

Archival research revealed that no archaeological sites of either prehistoric or historic period age or character have been recorded within the confines of the proposed project area. It should be noted that a very limited portion of the present research area has been subject to formal archaeological scrutiny. It is possible that an absence of recorded cultural resources within the proposed inundation zone is attributable to a lack of formal research rather than to a demonstrable paucity of archaeological sites or associated materials.

Previous archaeological inquiry did result in the recording of two sites within a radius of one mile of the project area: these are CA-CCo-355 and CA-CCo-356, recorded in 1977 along Pinole Creek, approximately three quarters of a mile west of the present site. Both CA-CCo-355 and CA-CCo-356 appear to represent habitation sites characterized by substantial shell midden deposits of some depth.

Based on findings of the literature search describing previous archaeological investigations in the vicinity of the proposed inundation zone, it was determined that reasonable potential for the discovery of possibly significant cultural resources within the confines of the property existed.

Pinole Field Reconnaissance

Between April 13-15, 1987, on-site reconnaissance of the proposed Pinole Reservoir was undertaken. The surface survey was conducted by six team members from Archeo-Tec. The 860 acre area was systematically criss-crossed in similar manner as Buckhorn.

On-site surface reconnaissance encountered one distinct prehistoric archaeological site of apparently substantial dimensions. This site, given temporary designation of HPR-1 by the survey team, has been assigned an official trinomial designation CA-CCo-549 by the staff of the Northwest Information Center at Sonoma State University. On the basis of surface characteristics, CA-CCo-549 appears to represent a significant habitation site, however, few other details concerning the areal extent or specific archaeological characteristics of this midden deposit are presently available.

CA-CCo-549 is a probable habitation site featuring rich black midden containing fragments of shell (including Mytilus sp.), chert and chalcedony debitage. It is situated on level ground overlooking the confluence of Pinole Creek and an unnamed drainage. Based upon observable surface characteristics, the site appears to measure approximately 250 x 250 ft. This estimate is probably on the conservative side; it may actually be considerably larger. The on-site reconnaissance indicates that CA-CCo-549 is in pristine condition.

In addition to CA-CCo-549, the survey team identified a cultural isolate -- in the form of a large shell fragment -- at a place where a local resident claimed to remember the presence of an archaeological site. Temporarily identified as HPR-A, this isolate has now been officially identified as CCo-Iso-12 by the staff of the Northwest Information Center at Sonoma State University. The land in the immediate vicinity of CCo-Iso-12 was under cultivation at the time of Archeo-Tec's April, 1987 survey. It was, unfortunately, impossible to determine if other surface or subsurface cultural resources were associated with the isolated shell fragment encountered.

The large fragment of clam shell (Macoma nasuta) was recovered in the south-central portion of the project area, where intensive cultivation has been taking place for many years. Other than the single clam shell fragment, no other evidence of archaeological resources of either prehistoric or historic character were encountered in the vicinity. A local resident informed the survey team that he had, while plowing a field, encountered a large, intact stone bowl beneath the surface of the ground in the same spot where the clam shell fragment had been recorded. This suggests that an archaeological site of unspecified dimensions and contextural integrity may exist within this portion of the property at undetermined depth beneath the surface plow zone.

On July 24, 1987, on-site reconnaissance for supplemental portions of the Pinole Reservoir Project were undertaken. In practical terms, the bulk of this work consisted of systematically surveying the approximately 4-mile alignment slated for the relocation of Pinole Valley Road. The entirety of the projected road alignment, as well as the designated construction staging area, were criss-crossed in a series of 60 ft. transects in an attempt to locate and identify cultural resources. All topographic features or other potential indicators of the presence of archaeological materials -- i.e., areas adjacent to stream courses and springs, rodent disturbance, cattle wallows or bedrock outcroppings -- were noted and intensively investigated by the three-man survey team.

No other evidence of archaeological resources of either prehistoric or historic age or character were encountered within the subject property under study. No isolated artifacts were encountered, nor were any anthropic soils observed. On the basis of evidence obtained through on-site reconnaissance, it is the judgement of the archaeological consultant that no additional exploratory archaeological procedures are needed.

LOS VAQUEROS

The Los Vaqueros Reservoir site was surveyed for cultural resources in 1982 by Dr. David Fredrickson of Sonoma State University. The survey revealed 35 cultural heritage sites on roughly 8,100 acres. Of these, 22 represented Native American use of the area and 17 were connected to historic period use. Four sites showed evidence of both historic period and Native American use. Documentary research indicated that the area may have been occupied in the late 18th century by the Bay Miwok, Plains Miwok, Yokuts, and Ohlone.

5.9.3 IMPACTS AND MITIGATION MEASURES

BUCKHORN AND PINOLE SITES

Based on findings of the literature search and archaeological surface reconnaissance, the following impacts are presented for consideration. Identification of surface manifestations of confirmed archaeological sites as well as distinct cultural isolates within the proposed Buckhorn and Pinole reservoir areas suggests probable existence of subsurface archaeological resources within the confines of the subject properties. Also, the fact that no previous archaeological research has been conducted within, or immediately adjacent to, the inundation sites suggests that due caution be exercised when evaluating the cultural resources potential of both areas.

On the basis of data presently available, it was concluded that there is a possibility of encountering cultural resources of demonstrated or potential significance within both the proposed Buckhorn and Pinole Reservoir inundation zones. At present, it appears that CA-Ala-481482H and CA-CCo-549 offer an opportunity for recovery of possible archaeological materials.

It is recommended that a limited program of subsurface archaeological testing be conducted in the vicinity of these areas of the subject property. The specific purposes of the proposed testing procedures are threefold: 1) to determine the presence or absence of subsurface archaeological resources in the immediate vicinity of the Buckhorn and Pinole dam sites; 2) to compile data regarding the vertical and horizontal extent, as well as the cultural characteristics of any subsurface archaeological deposits that are found to exist; and 3) to provide the District with appropriate recommendations regarding any additional exploratory procedures deemed necessary to further investigate and/or mitigate adverse impacts to those cultural resources of demonstrated or potential significance which have been identified and characterized within the confines of the proposed inundation zone.

It is recommended that the District retain the services of a qualified archaeological consultant for any subsurface testing procedures conducted within the confines of the subject property. Between six and eight controlled, hand excavated archaeological test units should be placed in the vicinity of CA-Ala-481 and 482H and between two and six

units in the vicinity of CA-CCo-549 and HPR-A. Between two and four controlled, hand excavated archaeological test units should also be placed in the vicinity of cultural isolates HBR-A and HBR-B. Specific locations of these proposed test excavation units should be determined by the archaeological consultant. Hand-excavated auger borings can be utilized to supplement data retrieved from the controlled archaeological test units.

If subsurface archaeological resources are encountered in the field, an appropriate program of laboratory analysis should be conducted. The purpose of the laboratory research would be to systematically analyze and interpret any data encountered in the field. At conclusion of the laboratory program, the consultant would compile and submit a written report describing findings, interpreting their significance and offering recommendations for any additional exploratory procedures deemed necessary to further investigate and/or mitigate adverse impacts to those cultural resources of demonstrated or potential significance identified within the confines of the proposed inundation zone.

Prior to commencement of field testing procedures within the subject property, the archaeological consultant under direction of the District would engage in appropriate consultation with representatives of the local Native American community, to insure that their input and concerns are incorporated into the archaeological testing program.

In closing, this discussion is incomplete without a final cautionary caveat regarding mitigating measures. It is conceivable that cultural resources of demonstrated or potential significance lie undetected within some portion of the proposed reservoir project areas. In the event that unanticipated archaeological resources were to be encountered, all earthmoving activity in the area of impact should cease until the District retains the services of a qualified archaeological consultant, to examine the findings, assess their significance and offer proposals for any procedures necessary to investigate and/or mitigate adverse impacts to those cultural resources encountered.

LOS VAQUEROS

Reservoir construction phase would have an adverse impact on cultural resources in the affected area. A number of cultural resource sites would be inundated. In addition, the

method of operation could have further adverse impacts on cultural resource sites in the project area. The long-term impact of repeatedly filling the reservoir and then drawing it down could erode the land contours and adversely impact sites in the drawdown area. The degree of impact would have to be considered in relation to final project design and the specific cultural resource sites involved.

Mitigation Measures

If existing cultural resource sites are determined to be eligible for the National Register of Historic Places, consideration will be given to appropriate mitigation measures. A final mitigation plan would depend on the reservoir size and specific project features. The following types of mitigation measures would be considered.

- If during construction previously undiscovered cultural resource sites are encountered, work in the immediate area would cease until a qualified archaeologist could be consulted.
- Avoidance and/or protection of cultural resource sites where possible during land management operation and construction.
- Covering selected inundated sites with some form of protective covering such as gunnite, polypropylene, plastic, or gravel.
- Developing a program of data recovery for sites that could not be protected.
- Limit recreation access to avoid sensitive sites.

Proposed mitigation measures are expected to reduce adverse impacts on archaeological sites to less-than-significant levels.

5.10 VISUAL QUALITY

5.10.1 SETTING

The proposed project sites are located on lands owned by the District. Visual character of the two sites is similar, consisting of steep sloping and rolling hills covered by grassland and oak woodland.

BUCKHORN SITE

The Buckhorn Reservoir site, in the Oakland Hills, shares a valley with an arm of the existing Upper San Leandro Reservoir. The proposed dam site is located below the confluence of Buckhorn and Kaiser Creeks on an arm of the Upper San Leandro Reservoir. The project area and surrounding lands are within EBMUD's watershed. Portions of the property are densely wooded, while other areas are open grassland; livestock graze throughout watershed lands. Figure 5-17 depicts the typical visual character of the Buckhorn site.

EBMUD hiking trails pass through the watershed, surrounding the project area on all sides. Views of the project site are obtained from vantages along the trails; however, vegetation and landforms screen or block views. Entry to the trails is limited, furthermore, trails within the Upper San Leandro Reservoir require Trail Use Permits, additionally restricting access. The Buckhorn site is partially visible from Redwood Road at only one point along the highway. Visual access to the proposed project site is best accomplished from the air.

PINOLE SITE

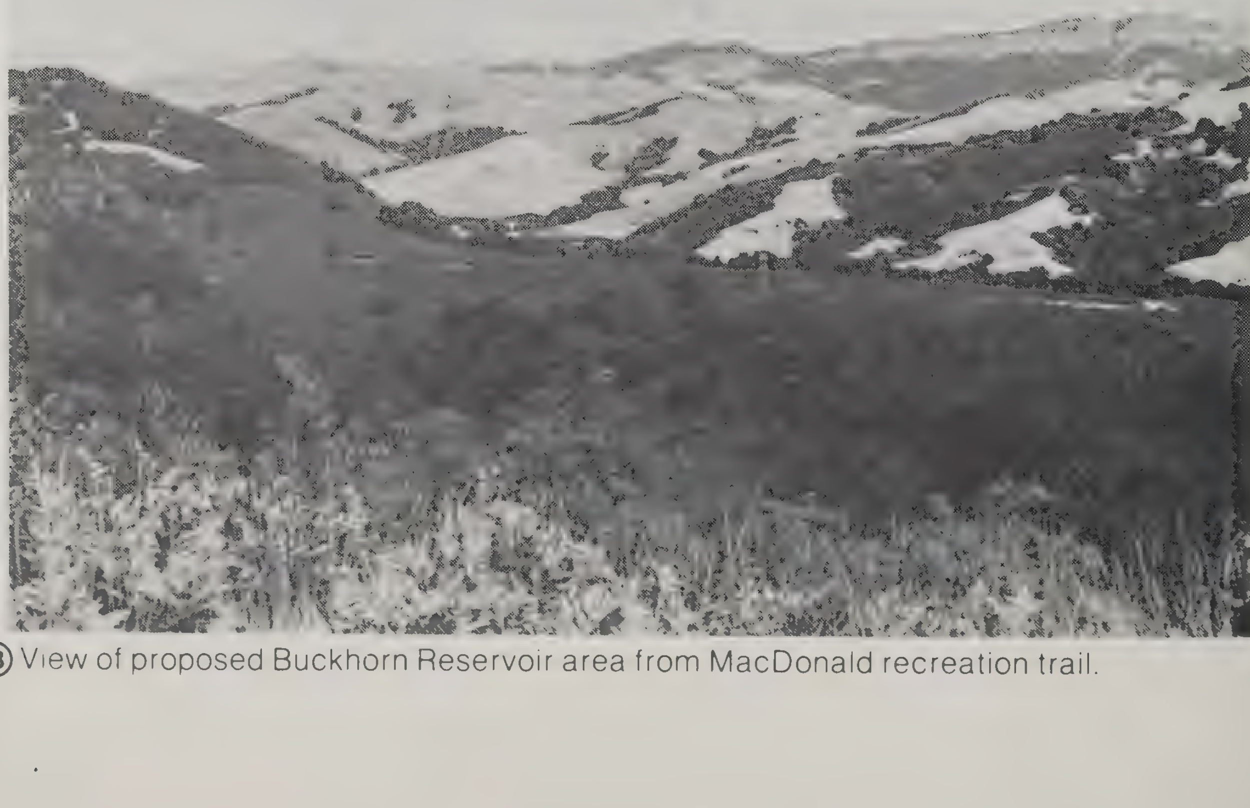
The Pinole Reservoir site is located in hills to the east of the cities of Pinole and Hercules. Visual character of the Pinole site consists of terrain which is generally open and more rolling than the Buckhorn site. Cattle graze on rolling grass covered hills which are scattered with clusters of oak trees. Figure 5-18 illustrates typical visual character of the Pinole site.

The Pinole site is visible from two local public roads, Pinole Valley Road and Castro Valley Road. Sections of these roads are located within the proposed project area and would require relocation.

SITE PHOTOS-BUCKHORN RESERVOIR

FIGURE 5-17

Ⓐ Typical visual character of Buckhorn site and existing EBMUD watershed lands.



Ⓑ View of proposed Buckhorn Reservoir area from MacDonald recreation trail.

SITE PHOTOS-PINOLE RESERVOIR

FIGURE 5-18

Ⓒ Typical visual character of Pinole site.

Ⓓ Looking toward location of proposed Pinole dam site

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LOS VAQUEROS

Kellogg Creek watershed is an attractive valley east of Mt. Diablo in the hills south of Brentwood. Views of the watershed are afforded from Vasco Road, which traverses the project area adjacent to Kellogg Creek with riparian areas. Views are also available from Morgan Territory Road, which skirts the southwest ridge of the watershed.

The farmed and grazed hillsides of the dryland valleys lend a distinctly rural visual character. Springtime grasses provide lush, verdant views, and give way to the brown, dry grasses of summer and fall. The valleys are interspersed with occasional oaks.

A northbound traveler on Vasco road enters the watershed north of Livermore by crossing a low pass, and then winds down through grazing areas to a broad valley with hay cropping. The valley narrows suddenly at the Los Vaqueros dam site to form a narrow pass for Kellogg Creek and the road, and then opens into a lower, open valley.

Few structures are visible in the watershed; a few homes, wind turbines, and agricultural structures are the primary man-made features of the area as seen from Vasco Road. Numerous homes are visible along Morgan Territory Road.

5.10.2 POTENTIAL IMPACTS

Visual impacts occur when visual conditions described in the setting are altered or disfigured to accommodate a proposed project. Visual impact is also a measure of the degree to which an observer of the setting is aware of visual change brought about by a project. For the proposed Buckhorn and Pinole sites, visual impact would be measured by a number of factors including: 1) the number of people who are currently exposed to the site in its current state on a daily basis; 2) the number of people who would view the completed project on a daily basis; 3) the height and breadth of the proposed dam structure; 4) the area of inundation behind the dam; and 5) the relocation of existing site features such as roads and above ground utilities.

BUCKHORN PROJECT

The proposed project would add an earthfill dam reservoir and water supply to the landscape. The new reservoir created by the dam would flood Riley Canyon, Buckhorn Creek and Kaiser Creek, greatly enlarging the present arm of Upper San Leandro Reservoir. Figure 5-17 shows the location of the proposed dam site. The Buckhorn dam would be about 370 ft. in height with a crest length of 1,600 ft. Two rock-filled dikes would be constructed along the reservoir's south side ridge. Upstream and downstream coffer dams would be built for main dam dewatering purposes during construction. The structures would be visually prominent and obviously man-made.

Aggregate materials needed for construction of the rockfill dikes, main dam spillway and other concrete structures, as well as surface rip-rap, may be available from upstream borrow sites. Assuming that this is the case, the utilization of borrow sites could result in significant disfigurement of the valley walls. Regrading and revegetation of the borrow sites would reduce visual impacts over time as vegetation matures.

The project would also require construction of a pumping plant near St. Mary's College in Moraga. The pump station would be approximately one-story above ground, with the remainder of the structure below ground, thus diminishing visual impacts.

Site preparation would include clearing, grading and excavation of borrow areas. These activities would result in further visual impacts. In addition, 26 high voltage PG&E transmission towers would require relocation or removal from the inundation area.

The proposed project would in effect enlarge the existing Upper San Leandro Reservoir by inundating Riley Canyon, Buckhorn Creek and Kaiser Creek. Existing visual conditions of these areas would cease to exist. As access is controlled, only limited numbers of the public would be exposed to these changes; therefore, loss of visual resources described in the setting section would not be considered significant for this site.

Because of topography and existing vegetative patterns, visual access to the site is generally limited to trail users and people flying directly over the project area. Portions of the Rocky Ridge trail, where it crosses the northern reach of Buckhorn Creek, would be inundated and would require relocation.

During project operation, water levels below full capacity of the impoundment would reveal barren earth between the water surface and vegetation of the high water rim. The ring of barren shore line would visually contrast with the present setting of rolling grassland hillsides. As noted previously, this adverse impact would only be apparent to limited numbers of people who utilize the controlled access and entry trails. The adverse visual impacts associated with the barrier ring would be most severe during droughts when the reservoir water surface would be drawn down.

PINOLE PROJECT

As with the Buckhorn site, the proposed project at the Pinole site would include an earthfill embankment dam. Maximum height of the dam would be 195 ft. at the centerline of its axis, while its crest length would be 1,700 ft. Spillway crest elevation would be 340 feet msl. The dam would be visually prominent and obviously man-made. The project would also include construction of a pumphouse located just below San Pablo Dam on EBMUD land. The pumping station would be approximately 26 ft. in height, but would be constructed partially below grade thus decreasing visual impacts.

Relocation of portions of Castro Valley Road and Pinole Valley Road and private fire roads would be required. In addition, four PG&E high voltage transmission towers would need to be removed from the inundation area. The project would result in significant visual change over existing conditions. Currently, the public has visual access to the site from existing roads and private high lands on the south side. Opinions can differ as to whether views from these areas would be impaired or enhanced. Some may feel that the conversion of this valley to reservoir is undesirable while others may feel that it adds visual interest.

Adverse visual impacts associated with project operation would occur when water levels would fall below full capacity within the reservoir, revealing barren earth and contrasting with the grassland setting of the surrounding rolling hillsides.

LOS VAQUEROS

Views of the area are unlikely to change noticeably as a consequence of purchase and subsequent management of the watershed. Predictable changes would not be visually significant.

Construction of the dam would involve adverse visual impacts. If Vasco Road were relocated prior to the start of construction, and relocated outside of the watershed, views of dam construction may not be open to many observers. If the road remained in the watershed where it overlooks the dam area or construction material borrow areas, a large number of people would be affected by the alteration of the view.

When completed, the reservoir would be filled. Many of the construction scars would be covered with water, and exposed excavations may heal with revegetation naturally, or assisted, as part of project design. The reservoir would appear as a large lake, occupying from 30% to 40% of the watershed when full. Whether this change from rural valley to lake is visually beneficial or adverse is subjective; the authors, however considered the change significant. The dam would constitute a substantial geometric form, obstructing views up Kellogg Creek. The structure would appear massive and clearly man-made.

Filling and drawing water from any reservoir would have a impact on the visual character of the facility. When full (at maximum pool), the reservoir would be at its most attractive; a neat shoreline with vegetation reaching the water line would be visible except where recreational development or construction have altered vegetation.

When the reservoir were drawn down, however, the shoreline area would appear as a muddy ring, with its width depending on the amount of drawdown and slope of the bank. When the water were lowered to its maximum, as would occur for drought-year operations, the visual impact would be adverse.

Realignment of Vasco Road would create some visual scarring from excavation and filling along its route. If the road were relocated outside of the watershed, it may open up new vistas, especially if it traverses a ridge line.

5.10.3 SUGGESTED MITIGATION MEASURES

BUCKHORN

If borrow material cannot be obtained from the inundation area mitigations required would include regrading and revegetation of borrow sites to minimize unnatural topography and scarring. Other mitigation measures include relocation of trails, and careful siting of the pump station. The pump station should be designed and constructed so that it is not visually obtrusive; materials selected should be compatible with the visual

character of the surrounding area. Landscaping and screening devices such as fences would be employed as is the case with other District facilities located in public areas.

Relocation of the transmission lines would require careful planning to decrease visual impacts or at least not increase them, especially if taller or larger support towers are required.

PINOLE

The Pinole site would be visually apparent from several off-site locations and would result in considerable visual change to the area. The reservoir might be visible from existing residential development along Castro Valley Road, slightly southwest of the site.

Landscaping could be employed to diminish the visual impact of the project as viewed from relocated roads and adjacent residential development. Vegetation could also screen the proposed pumping plant from view.

As with the Buckhorn site, relocated transmission lines will require further consideration to establish proper siting that decreases visual impacts or at least does not increase them beyond current levels.

LOS VAQUEROS

Authors of the Los Vaqueros EIR proposed the following measures:

Adverse aesthetic impacts could be reduced by:

- Confining construction to the minimum areas necessary; this can be facilitated by working from the reservoir pool area rather than the area downstream of the dam.
- Locating borrow areas within the reservoir pool area rather than in areas that would be exposed to view after reservoir filling. Borrow areas that would be frequently exposed during reservoir drawdown (areas near the higher elevation of the pool) should be contoured to avoid angular, quarried appearances.
- An operating schedule should be employed to accustom the public to some fluctuation in water level.
- The dam face could be aligned or contoured to blend into the terrain to some degree. Revegetation of an embankment dam or dike would also assist in softening its visual impact.
- Following construction, any work areas outside of the pool area should be regraded to approximate natural contours, and revegetated to restore consistent visual character.

5.11 PUBLIC HEALTH AND SAFETY

5.11.1 SETTING

Construction and operation of a new terminal reservoir will have some element of risk associated with it and therefore must be designed, constructed, and operated with features and measures that will ensure maximum protection for public health and safety. Potential public health and safety issues associated with the proposed terminal reservoirs include:

- Occupational hazards during construction
- Risk of dam failure due to earthquake
- Risk to public from insect vectors

All three sites consist predominantly of grassland and are designated as high-risk fire areas, however much of the grassland areas are grazed, so fires within the watersheds are relatively infrequent.

The three sites are all relatively close to the San Andreas and Calaveras faults. There are also many smaller local faults within the vicinity of each dam site.

5.11.2 IMPACTS

Risk of Dam Failure

Construction of either dam would subject areas below the site to potential devastation in the event of dam failure. Although a very remote possibility, dam failure could occur due to a structural failure of the dam itself or its foundations. Such failure might be promoted by groundshaking induced by movements on nearby geologic faults. The dam might be overtopped by a wave produced by a landslide, perhaps earthquake-induced, into the reservoir (landsliding is discussed in Section 5.4, Geology and Soils).

An internal study was performed by the District to estimate flood wave heights and travel times that would result from a dam break at either the Buckhorn or Pinole reservoir site. The model used hydrodynamic theory to predict dam-break wave formation and downstream progression.

Predicted inundation zones and time-lines along the outlet water course channels were developed. Peak discharges of 1.26 million cfs at Buckhorn and 760,000 cfs at Pinole were calculated. Times from the start of a breach until a flood wave arrives at various points downstream are expressed in Table 5-7.

Failure of the proposed Buckhorn dam would result in overtopping and probable failure of the Upper San Leandro and Chabot dams followed by subsequent inundation of all lowlying areas of the City of San Leandro and portions of Oakland and San Lorenzo.

Failure of a Pinole dam would result in near complete inundations of the City of Pinole and of portions of the City of Hercules.

TABLE 5-7

DAM-BREAK WAVE PROGRESSION

Buckhorn[1]		Pinole	
Location	Time (hr/min)	Location	Time (hr/min)
Dam Failure	0:00	Dam Failure	0:00
Peak Outflow	1:10	Peak Outflow	1:02
Upper San Leandro Dam Failure	0:46	Pinole Valley Road:	
Peak USL Outflow	1:44	Marlin Ct.	1:04
Willow Park G.C.	2:00	Savage Avenue	1:08
Chabot Dam Failure	1:40	Olinda Ct.	1:12
Peak Chabot Outflow	2:06	Interstate 80	1:14
MacArthur Freeway	2:16	Tennent Avenue:	
Estudillo Avenue	2:22	Prone St.	1:18
Estudillo Park	2:38	Tennent Ct.	1:22
Nimitz Freeway	3:04		

[1] 680 ft. elev. dam

A number of initial predesign measures have been taken by the District as required by state law to ensure that risks of dam failure are minimized. Baseline geotechnical studies of the sites have been conducted indicating active earthquake faults do not pass through any of the sites. The studies have also gathered the data necessary to estimate the maximum credible earthquake that might occur on nearby faults. Maximum credible earthquakes occurring on the Hayward, Calaveras and San Andreas faults are estimated to be Richter magnitudes 7.5, 7.5 and 8.3, respectively. Confidence bounds on these estimates are one-quarter of a magnitude unit. Any dam must be designed to withstand groundshaking produced by the maximum credible earthquake.

Dam design must also be reviewed and approved by the California Department of Water Resources, Division of Safety of Dams before construction can begin. The Division of Dam Safety is responsible for ensuring that all dams within the State do not create a threat to public safety.

Vectors

Vectors are organisms that carry pathogens from one host to another. Shallow water areas of the terminal reservoirs could be attractive to mosquitos. Any increase in mosquito numbers could be controlled by standard abatement methods. No impacts on visitors or residents dwelling near the reservoirs wouold be expected.

Fire and Occupational Hazards

The Districts watershed management program incorporates effective provisions to control the growth of grasses through grazing and other means, and to restrict public access to critical areas. During construction, the presence of fuels, lubricants, and heavy equipment could create some risk of accidents and other occupational hazards, and increase the fire danger. Risk of accidents and other occupational hazards is expected to be less than significant, assuming that Cal OSHA standards would be followed during construction. During construction, the public would not be permitted in any areas where heavy equipment would be operated or where fuels and lubricants would be used or stored. No significant adverse impacts to public safety are expected to occur during construction. However, there would be some minor risk of increased traffic accidents due to constructionvehicles. Construction activities would increase the risk of fire hazard in any of the project areas by an indeterminate degree.

5.11.3 MITIGATION MEASURES

Reservoir Construction

In order to reduce the risk of fire or accidents, the following mitigations are recommended. Many of these measures are incorporated in the proposed project.

- Existing access roads would be improved as required to provide safe vehicle and equipment mobilization and transport.
- Traffic control personnel would be to coordinate construction traffic and reduce the risk of accident with nearby public traffic.
- Adequate warning signs would be posted where substantial construction traffic is to occur on public roads.
- Construction vehicles and equipment accessing the construction sites would undergo regularly scheduled maintenance.
- All vehicles and equipment would be equipped with fire extinguishers and spark arrestors.
- New access and haul roads would be constructed or improved as required to provide safe vehicle and equipment transport. Such improvement would include the development of turnouts, as necessary.
- Fire extinguishers would also be available at strategic locations throughout the construction sites.
- Use of gasoline and gasoline engines would be minimized. It is assumed that the primary fuel used to operate vehicles and equipment would be diesel.
- Welding, cutting, and grinding would be conducted with the proper clearance of any flammable material and with proper fire-fighting equipment nearby.
- All electrical installations would be designed and constructed to the standards of applicable codes.
- Telephone communications would be readily available to telephone fire-fighting authorities if necessary.
- All blasting materials would be stored properly in a posted segregated area.

Reservoir Operations

No additional mitigating measures are deemed necessary to further protect public health and safety beyond those standard practices incorporated by the District in operation of their other terminal reservoirs and those design practices necessary to meet State seismic safety standards.

6 LEVEE AND FOUNDATION IMPROVEMENTS IN THE DELTA

6.1 PRESENT CONDITIONS

The District's water supply system is subject to natural disasters that could cause extensive damage to facilities and result in severe water supply outage. One of the most vulnerable segments of the District's water supply system is where the Mokelumne aqueducts cross the Sacramento-San Joaquin Delta region. The numerous islands and tracts of the Delta region are surrounded by 1,100 miles of levees and 600 miles of waterway. Most of the islands and tracts crossed by the pipelines are 20 to 25 feet below mean sea level and generally subsiding at a rate of two to three inches a year which has necessitated increased need for continued improvements and upgrading of the levee system. The District is a major contributor to levee maintenance and improvements on islands and tracts crossed by the Mokelumne Aqueducts.

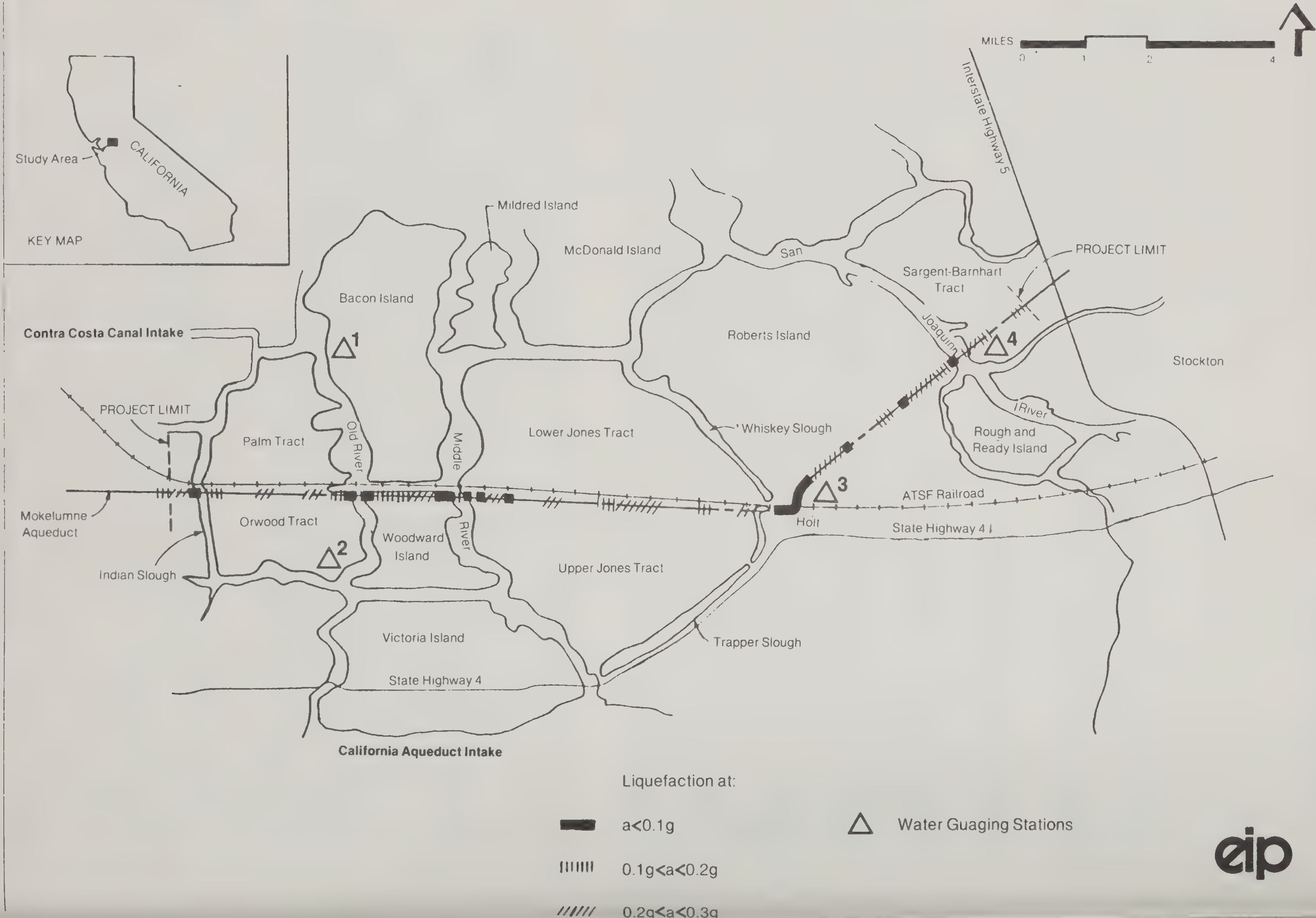
6.1.1 DISTRICT FACILITIES IN THE DELTA

There are three aqueduct pipelines that cross the Delta between Stockton and Bixler, over a 16-mile distance, as shown in Figure 6-1. Underwater crossings occur at San Joaquin, Middle and Old Rivers; while 9 miles of the all-steel pipeline are elevated above ground on piles extending across Upper Jones Tract, Woodward Island, and Orwood Tract.

The first pipeline (65-inch diameter) completed in 1928 is supported by concrete bents placed on top of wood piles. The second pipeline completed in 1942 is of 67-inch diameter supported by steel bents on concrete piles. The third 87-inch diameter line completed in 1963 is also supported by steel bents on concrete piles.

MOKELUMNE AQUEDUCT IMPROVEMENT LOCATION MAP

FIGURE 6-1



The remaining 6 miles of the aqueduct system consists of buried pipeline across Lower Roberts Island and Sargent-Barnhart Tract.

6.1.2 AQUEDUCT VULNERABILITY

The Delta segment of the Mokelumne Aqueduct system is vulnerable to both flood and earthquake. If a levee break occurs near the elevated portion, water scour can readily undermine pile supports and cause the pipelines to collapse. Subsequent inundation might also be a hazard to the submerged portions of the pipelines due to bouyancy (if a pipeline were to be emptied) and prevention of access. Groundshaking caused by seismic event occurring in the general vicinity of the Delta also represents a potential risk to the aqueduct. Temporary liquefaction of the water-saturated sandy soils could affect the integrity of the levels and their foundations, and also reduce soil support under the pipelines, river crossings and piles. A large earthquake could cause failure of the piles and supports under the elevated portions due to their inadequate structural strength.

Potential outages of the Mokelumne supply through the Delta have been estimated under various conditions. An outage of 13 months for repair and reconstruction has been used as a reasonable assumption for planning purposes based on reduction in demand and the probability of occurrence of seismic events.

The District has concluded that it must increase protection against extended outages in its conveyance facilities by making improvements for the following needs:

- Assurance of adequate high quality supply available for meeting reduced demand during an extended outage of the Mokelumne supply; and
- Limit the severity of rationing during an extended outage.

6.1.3 ALTERNATIVE MEASURES

Conceptual alternatives for improving security of the District's Mokelumne water supply through the Delta include:

- No Action -- Do nothing, continued deterioration.
- Levee and Foundation Improvements -- Levee repair and improved maintenance, studies and design of rehabilitation and replacement facilities.

- o New Pipeline -- Entirely new pipeline(s) across Delta to carry full flow.
- o Additional Terminal Storage -- As discussed in the previous chapter, a 145,000 AF reservoir could supply sufficient water for a 13-month outage at 25% demand reduction.
- o Interties with Other Agencies -- Water would be available but at insufficient levels to meet the extended outages under consideration.
- o Delta Water -- Although sufficient quantity is available, salt water intrusion from the Bay may make it infeasible during an extended outage.
- o Groundwater Resources -- There are groundwater resources of 1-2 mgd located within the District.
- o Water Conservation and Reclamation -- There would be a water savings but at insufficient levels to meet the extended outages under consideration.

The most feasible alternative to "no action" involves pursuing levee and foundation aqueduct improvements while considering both a new pipeline system and construction of additional terminal storage.

6.2 PROPOSED ACTIONS

6.2.1 LEVEE REINFORCEMENT STUDY

The Phase I technical feasibility studies would determine the best method of reinforcing Delta levees adjacent to the Mokelumne Aqueduct in order to protect the conveyance system from flooding and earthquake events.

6.2.2 PILE TEST STUDY

In addition, a pile test study has been proposed to determine pile driving techniques and limitations, vertical and horizontal load capacity, seismic response, pile size, number, orientation, length and strength in order to provide a secure aqueduct.

The study would be performed on Woodward Island, Upper Jones or Orwood Tracts between Holt and Bixler, south of the existing right-of-way for the Mokelumne Aqueducts. Study data would be used to evaluate alternative security projects that include: buttressing levees or a sheet-pile scour shields at river crossings; purchasing all or critical portions of the islands at or near the aqueducts and improving levee maintenance; parallel

protective levees along the aqueducts; new single or double aqueducts; buried or elevated, in all or part of the critical 16-mile Delta section; and a causeway with a single or double pipeline.

6.2.3 TESTING AND DESIGN

The pile test program would require a minimum of four years to complete; and design of a new conveyance system would take another year or so. Until results of the testing program are available, any repairs to the existing aqueducts may not result in a secure aqueduct, instead, a repaired aqueduct may remain vulnerable to future damage.

Estimates of the cost of the study work including District, consultant and contractor costs are about $1.5 million over the duration of the proposed preliminary engineering feasibility program for aqueduct improvements. A comparison between existing aqueduct repair and construction of a new structure across the Delta (in order to secure the system from flooding and earthquake events) is also part of the preliminary design effort.

6.2.4 LEVEE MAINTENANCE

Plans to improve security of aqueducts in the Delta include levee repairs, maintenance, and preliminary engineering to protect against both earthquake and flood damage. Levee repairs and maintenance would involve completion of minor repairs, upgrading, and raising (the levees) at crossings and along the alignment of the elevated aqueducts. This would provide increased security against levee failure due to erosion or overtopping. The repairs and maintenance, however, will not reduce the risk of an extended outage during high and very high levels of groundshaking.

Repairs and maintenance of Delta levees since 1981, including minor repairs, upgrading, and raising levees at river crossings, have cost $3.2 million. EBMUD has contributed over $1 million to the levee work in the last seven years. An inspection conducted in March 1987 by the District's Aqueduct Section indicated that further levee improvements will be necessary on Woodward Island, Palm Tract, and Lower Jones Tract. The District is planning an additional $2 million for completing this work. The proposed improvements would be eligible for State reimbursement and would extend over five years.

Substantial levee improvements have been made on Woodward Island. Several locations along the east and south levees will need to have the crest elevations raised at a cost of about $0.9 million.

Palm and Orwood Tracts are separated by a railroad embankment similar to Lower and Upper Jones Tracts. Although the Mokelumne Aqueducts do not cross Palm Tract, flooding of Palm Tract would endanger the aqueducts on adjoining Orwood Tract. Required levee improvements on Palm Tract include raising the elevation to at least +8.3 feet MSL and widening the levees. Improvements to Palm Tract's levees will cost about $1.0 million.

The aqueducts also do not cross Lower Jones Tract; however, flooding of this tract will pass through the trestle section of the embankment that separates Lower and Upper Jones tracts. Since flooding of these tracts in 1980, the District approved a resolution to contribute $50,000 toward levee improvements on Lower Jones Tract. Due to the opening in the railroad embankment, Lower Jones Tract levees are even more vital to the security of the Mokelumne Aqueducts. Recommended levee improvements consist of raising the elevation to at least +8.3 feet MSL and widening at a cost of up to $1.0 million.

6.3 ENVIRONMENTAL SETTING

6.3.1 HYDROLOGY AND WATER RESOURCES

The Sacramento-San Joaquin Delta is a low lying alluvial floodplain occurring along the confluence of the Sacramento and San Joaquin River systems. Numerous meandering rivers and sloughs traverse the Delta. These rivers are all freshwater, but are subject to tidal action from the Pacific Ocean-San Francisco Bay system. The freshwater/saltwater boundary currently occurs at the extreme western end of the Delta where the Sacramento and San Joaquin Rivers meet and flow into Suisun Bay. However, this boundary is variable, depending upon inflow and outflow conditions.

Background

About 130 years ago, the Delta was an area of tidal marsh and grassland subject to periodic inundation by unusually high tides or river flows. During the winter and spring the waters of the Delta were fresh because flow from the Sacramento and San Joaquin

Rivers was sufficient to hold back the saline waters of San Francisco Bay. For short intervals, during the summer months of dry years, salt water penetrated far into the Delta.

Over the years, the marshlands of the Delta were reclaimed by levee construction and converted to agricultural use. By 1930 all marshland suitable for reclamation had been reclaimed. Increased upstream irrigation diversion, reclamation, and flood control efforts combined to increase the salt water incursion into the Delta after 1920. Both agricultural water users on the Delta islands and municipal and industrial users obtaining their water supply from the western Delta were inconvenienced by periods of poor water quality and low Delta outflow. In 1940, the Contra Costa Canal was constructed with its intake at Rock Slough in the western Delta. The canal provides a supply of water to portions of Contra Costa County, including the municipalities and industries which are partially dependent on diversion of water from the Sacramento and San Joaquin Rivers in the zone of salinity incursion. High levels of salinity continued sporadically until 1944, when the construction and operation of Shasta Dam increased the summer outflow through the Delta and thereby reduced the maximum extent of the incursions.

The Delta currently encompasses about 60 leveed islands and tracts. Nearly all of these islands are reclaimed marsh land and depend on man-made levees and pumping for protection against inundation by the river systems that traverse the area. The reclaimed land is generally used for agricultural and animal production.

River Stages and Flooding

Much of the Delta area is at or below mean sea level (msl) and is mostly reclaimed land protected by levees. It is an area subject to flooding. The term "flood stage elevation" is used to quantify flooding potential for given return occurrence. For example, a 25-year flood stage elevation of 5 ft. above msl means that the water level at that specific location would be expected to be 5 ft. above mean sea level once every 25 years. Therefore, anything below 5 ft. msl would be subject to flooding every 25 years.

Levees can be affected by flood levels in various ways. First, the flood elevation can be greater than the levee elevation, thereby inducing flooding. Second, high water elevation accompanied by winds creates waves that can batter and possibly erode levees. The worse the levee condition, the greater the chances that levee failure will occur.

Flood and tide stage-frequency relationships for the waterways of the Sacramento-San Joaquin Delta river system have been developed by the U.S. Army Corps of Engineers (COE). Findings were based on measurements of 24 stage gauges installed at different locations throughout the Delta in the early 1940's. Readings from 1945-1974 were revised to correct for subsidence after a 1974 USGS survey. Graphs showing higher high tide stage-frequencies have been prepared for all gauging stations. Stations in the general vicinity of the Mokelumne Aqueduct crossings (as shown in Figure 6-1) were calculated to have 50- and 100-year flood stages as presented in Table 6-1. It should be noted that in their hydrological model, COE assumed that a number of islands would fail during high stage flooding and hence would attenuate the flood elevations at other areas accordingly.

Groundwater

The Mokelumne Aqueduct crosses four islands between the San Joaquin River and Indian Slough. Each of these islands is protected from inundation by man-made levees. The groundwater surface in these levees undergoes minor fluctuations in conjunction with tidal fluctuations in the adjacent waterways. Except for a number of isolated areas where seepage was actually observed or otherwise suggested, the groundwater surface appears to be contained within the levees. Groundwater levels in the island interiors are controlled by drainage ditches and dewatering pumps. These groundwater levels are generally maintained at a depth of three to five feet below the ground surface.

West of Indian Slough the existing aqueduct alignment rises above mean sea level. A few borings in this vicinity have indicated a groundwater table occurring between five and ten feet below the ground surface, and apparently subject to seasonal variation.

Water Supply

The Sacramento-San Joaquin Delta is the source of water for the Contra Costa Water District and the California Aqueduct.

The Contra Costa Canal has its intake at Rock Slough about 2.5 miles north of the Mokelumne Aqueduct. The California Aqueduct originates about 5.5 miles south of the Mokelumne Aqueduct, at Clifton Court Forebay. Both intake sources are shown in Figure 6-1.

TABLE 6-1

FLOOD STAGE ELEVATIONS AT SELECTED DELTA LOCATIONS

Gauging Station[1]	Location	Flood Stage Elevation[2] 50 yr.	Flood Stage Elevation[2] 100 yr.
Rock Slough	Old River W. of Bacon Island	6.9	7.2
Byron Tract	Old River W. of Victoria Island	7.3	7.6
Borden Hwy.	Middle River at State Hwy. 4	7.3	7.6
Burns Cutoff	Jct. San Joaquin & Calaveras R.	7.2	7.5

[1] See Figure 6-1 for approximate location

[2] U.S. Geological Survey mean sea level datum

Source: U.S. Army Corps of Engineers, Sacramento-San Joaquin Delta, California, Stage-Frequency Study, December 1976

6.3.2 GEOTECHNICAL CONDITIONS

The 16-mile segment of the Mokelumne Aqueduct that is being considered for improvement crosses the Sacramento-San Joaquin Delta system near or below sea level. The islands and tracts along the aqueduct corridor are generally bowl-shaped. The "rims" of the bowls are formed by levees which rise to about 15 ft. above mean lower low water (mll). The bowl "bottoms" are as low as -15 ft. msl.

The eastern limit of the corridor is about one mile west of Interstate Highway 5, where the aqueducts crosses Brookside Road in the Sargent-Barnhart Tract (Figure 6-1). The aqueduct is buried in this tract and passes under the San Joaquin River onto Roberts Island, where it is also buried. The surface of Roberts Island drops along the corridor and then rises at Holt, where the aqueducts turn due west and are elevated above ground level to parallel the Atchison Topeka and Santa Fe Railroad tracks. West of Holt, the aqueduct makes an elevated crossing at the north end of Trapper Slough and continues elevated across the Upper Jones Tract. The railroad embankment, which divides Upper Jones Tract from Lower Jones Tract is at about +8 ft. msl. The aqueduct passes through the levees at Middle River, under the river and onto Woodward Island where it is elevated. A third subaqueous crossing is made by passing through the levees at Old River, under the river and onto elevated structures across Orwood Tract. A final elevated crossing is made at Werner Dredge Cut (Indian Slough to Rock Slough) where the aqueducts are buried east of Bixler at the western end of the corridor.

Five soil "horizons" have been identified along the corridor. While these are reasonably consistent in vertical sequence, they vary considerably in location, specific composition, thickness and extent. Not all horizons occur at all locations. The general characteristics of each horizon are described in Table 6-2.

The rocks and sediments of the Central Valley are cut by numerous fault zones (Figure 5-10). These and other major faults in the Coast Range can produce earthquake-induced groundshaking in the Delta. The Antioch fault zone is about 12 miles west of Bixler. The Calaveras, Hayward and San Andreas fault zones are about 20 miles, 28 miles and 47 miles, respectively, southwest of Bixler. There are no active faults crossing the corridor.

TABLE 6-2

SOIL HORIZONS WITHIN THE AQUEDUCT CORRIDOR

Horizon 1:	Levee fill, composed primarily of dredged material from the adjacent sloughs. This horizon consists of variably mixed fine sands, silts and clays. The placement and degree of compaction of levee fill was generally uncontrolled and variable. Levees may rise to about 15 ft. above mean lower low water.
Horizon 2:	Composed primarily of silty clays, sandy silts and clayey silts, all of varying organic content. This horizon has characteristically young sediments deposited by estuarine processes.
Horizon 3:	Consists of a layer of black, highly compressible peat. The peat varies from fibrous to highly decayed organic matter and is intermixed with varying amounts of silt and clay. Thickness varies from zero at the outer edge of the Delta to about 60 ft. near the center.
Horizon 4:	Consists primarily of intermixed and interlayered sands and silts with clayey and silty zones. The sediments are generally loose to medium dense. They have low shear strength near the top of the horizon and become denser or increasingly stiff with depth. They are the result of alluvial processes.
Horizon 5:	Consists of dense sands of variable silt content interbedded with zones of stiff to very still silts and clays. The material is characterized by high relative density, high shear strength and low compressibility. These are older alluvial deposits.

Source: EBMUD.

The Delta area is in a seismically active region which annually experiences low to moderate magnitude earthquakes epicentered along the active fault zones. In 1979, a moderate earthquake (Richter magnitude 4.2) occurred along the San Andreas Fault and two moderate earthquakes (Richter magnitudes 4.8 and 5.9) occurred along the Calaveras Fault. Three earthquakes of Richter magnitudes 5.5 to 5.9 occurred along the Calaveras Fault in 1980. Based on records of previous earthquakes, groundshaking along the corridor during a maximum credible earthquake on one of these fault zones would be about IX on the Modified Mercalli Intensity Scale.

The combination of earthquake-induced ground acceleration and Delta soil conditions could cause soil liquefaction. Severe shaking of the saturated peat and sandy soil layers can produce a condition similar to quicksand, resulting in loss of support for any structures on the ground surface. Liquefaction can be induced at relatively low values of ground acceleration.

Peat and loose sandy soils are also easily eroded. Rapidly moving floodwaters that inundate Delta islands during a levee failure scour the ground surface and remove large quantities of soil. Elevated structures, undermined by scouring, are subject to overturning due to loss of soil support for their foundations. Hollow, buried structures -- such as the pipelines -- which are unearthed by scour, are subject to rupture since they can float and could be lifted or shifted far enough to surpass the strength of the steel pipe.

The geotechnical condition of the island levees controls their ability to withstand seismic and flooding stresses. Factors which are considered in determining levee conditions include levee height above water, crest width, steepness and protection of inboard and outboard slopes, and relative subsidence rates of the levees versus the islands or tracts they protect. The 1980 Department of Water Resources levee study indicated that the levees surrounding the islands that the aqueduct passes through were in "poor" condition (except for the Sargent-Barnhart Tract). The "poor" rating indicated that there were extensive oversteepened levee slopes, unprotected levee slopes, and low or narrow levee crests. The study indicated that these islands are subsiding at a rate of 1.6 to 3 inches per year, thus increasing the instability of the levees. Because these vulnerable areas are non-project levees, it is probable that conditions will continue to deteriorate.

6.4 POTENTIAL IMPACTS AND MITIGATION MEASURES

The potentially significant environmental impact on natural resources associated with the proposed preliminary engineering design activities would be related to geology and soils. The levee and pile test studies could have an adverse effect on the potentially liquefiable Delta soils. The purpose of the testing work is to better determine the consequences of such actions. The scale of the test program is such that any such potential impact would not be considered significant. The findings of the test studies will provide the basis for any mitigating measures required to offset or reduce potentially adverse geological impacts. These mitigation measures would be incorporated into the design of any proposed facilities, either of a remedial nature or new.

No other potentially significant impacts have been defined for the proposed preliminary engineering program. If a new pipeline were to be constructed during a subsequent phase of the WSMP, preparation of another project EIR for a proposed aqueduct would be necessary.

The proposed studies could also represent potentially adverse, although deemed as not significant, impacts on area traffic, ambient noise levels, and public safety as they involve foundation testing for levee failure. The pile testing program may create temporary increase in vicinity noise levels during the pile driving activities. As this impact is not considered significant due to the extent and nature of the proposed pile testing program, no mitigating measures are suggested.

Various methods of better securing the Delta portion of the Mokelumne aqueduct against flooding and earthquake will be evaluated during the preliminary engineering study and design work. A "no-action" alternative to the proposed study program, i.e., performing no tests and carrying out no technical evaluations, may reduce or eliminate potential impact of soils but would pose greater adverse impact on public health and safety, water quality and land use. Such environmental impacts would be considered significant and unavoidable.

Review of the potential effects of the proposed preliminary engineering and design studies for aqueduct improvements across the Delta on the region's natural resources and infrastructure resulted in no additional findings of substantial adverse environmental impact.

7 WATER CONSERVATION

7.1 PRESENT SITUATION

Water conservation has been a formal element of the District's water management policies since 1972. In November 1985, EBMUD updated and increased its water conservation efforts with adoption of the Urban Water Management Plan (UWMP). The UWMP included an expanded water conservation program which was developed to assure efficient use of supply specifically through implementation of effective water conservation measures.

7.1.1 BACKGROUND

The District began a pioneering effort in water conservation education in the 1960s by creating school programs and materials which are now used nationwide.

Early conservation efforts were aimed at developing long-term awareness of efficient water use through various educational and informational resource materials. Although an essential component of any water conservation program it is very difficult to estimate the actual quantity of water saved through these activities.

Throughout the 1960s and 1970s, the District also pursued a major program of leak detection and pipeline rehabilitation in its extensive distribution system. Active corrosion control and metering repair programs have also been in existence since the early 1970s.

7.1.2 URBAN WATER MANAGEMENT PLAN

The Urban Water Management Plan identified a series of water conservation measures shown in Table 7-1. Measures A, G, H, J and K are now fully implemented while B, C and

TABLE 7-1
WATER CONSERVATION PROGRAM ELEMENTS

A. WATER SAVING DEVICE DISTRIBUTION

Offer residential retrofit kits at EBMUD business offices and through water audits including low-flow showerheads and water bags for toilets to increase the number of water-saving devices installed in single- and multi-family residences as well as commercial, institutional, and industrial premises. (20,000 kits in first year)

B. WATER AUDITS

Offer to inspect water-use practices of existing industrial, commercial, institutional and single-family and multi-family residential customers and make recommendations for improved efficiency. Offer retrofit kits where applicable. Primary focus on indoor and process water use.

C. LANDSCAPE CONSULTATION

Introduce all existing and new customers to low water-using landscape concepts and materials through mailings and personal contact. Customer offered technical assistance and District literature.

D. LANDSCAPE REBATE

Offer a rebate to existing customers as incentive to install water-conserving landscapes that meet District criteria (up to $300/single family and $5,000/multi-family unit based on landscaped area).

E. SYSTEM CAPACITY CHARGE (SCC)

Offer discounts on the SCC paid by all customers who exceed code requirements for showerheads and toilets.

F. LANDSCAPE WATER USE EFFICIENCY IN NEW DEVELOPMENTS

Establish landscape water-use efficiency regulations for new residential, industrial, institutional, and commercial developments through cities and counties or by the District, if necessary; or offer incentives to install water-conserving landscapes that meet District criteria through an SCC discount or rebate program.

G. PUBLIC INFORMATION

Provide public information programs such as landscape booklets and brochures, exhibits, etc. to support and promote water conservation by demonstrating the methods for conserving water and benefits of efficient water use.

TABLE 7-1 continued

H. SCHOOL EDUCATION

Increase the promotion of wise water use habits and expand appreciation for water as a limited natural resource in primary and secondary schools.

I. SUPPORT ACTIVITIES

Establish a Landscape Advisory Committee to provide technical support and act as liaison with the professional landscape community.

J. DISTRICT WATER USE ACTIVITIES

Develop procedures to review District landscaping plans and retrofit existing District landscape to assure efficient water use.

K. WATER PRICING STUDY

Study water conserving rate structures as a means of increasing water use efficiency.

L. PRESSURE REDUCTION STUDY

Identify areas of high water pressure (greater than 80 psi) and investigate the feasibility of a pressure reduction program.

F are well underway. Measures D, E, I and L have yet to be implemented. A thorough description of the status of each measure is presented in the WSMP Technical Report (Chapter III).

The conservation measures of primary concern and their effects on water supply are discussed in Section 7.2 of this document.

Currently, EBMUD maintains a water conservation staff of five full-time employees. In addition to carrying out the long-term Water Conservation Program, this staff is responsible for implementing short-term water reduction measures in response to low water supplies such as occurred in this past year.

7.1.3 RECENT DEMAND REDUCTION MEASURES

Following the critically dry winter of 1986-87 in the Mokelumne watershed, EBMUD embarked on a voluntary demand reduction program in an attempt to persuade its customers to reduce water use by 12% over the previous year's level. Such effort was needed to minimize the risk and magnitude of supply deficiency in 1988 should this year prove to be dry as well.

The short-term measures of 1987 are listed in Table 7-2. Customer response to dry conditions was less than the desired 12% reduction. It was estimated that water use was only 5% below normal considering weather conditions during the past summer. The cost of the effort was $550,000.

7.1.4 CURRENT PROGRAM

An expanded water conservation program is currently being implemented. A water audit program has been initiated, and the District water saving devices have been distributed in a pilot program. The District published a water-conserving landscape book, and in November 1986 sponsored a Xeriscape Conference in Oakland. Draft landscaping guidelines are currently being formulated for new commercial developments. A weather station has been established at the Walnut Creek Filter Plant and will be a part of the California Irrigation Management Information System. The expanded program is to be monitored and evaluated on an annual basis to determine the effectiveness of each

TABLE 7-2

1987 DEMAND REDUCTION PROGRAM[1]

Conservation Workshops

District conducted 11 workshops for public agencies and large irrigators to provide information on landscape irrigation requirements and scheduling.

Water Use Reduction Request Letters

Postcards requesting water conservation were sent to all customers in May, 1987. Letters requesting conservation were sent to 7,000 large irrigators.

Lawn Watering Conservation Guides

Guides describing the amount and timing of lawn watering were sent to 282,000 customers.

Conservation Education in Public Schools

Water conservation information including bumper stickers, diamond signs, magnets, and other material were distributed to students in June and September of 1987.

Radio Ads Aired District Wide

A total of 666 radio spots were aired on 10 radio stations through September, 1987.

Conservation Placards on Public Transportation

Water conservation placards were placed on 210 AC Transit buses, and 30 placards were placed at BART stations.

Waste Watchers

Twelve summer employees patrolled the service area looking for water waste. Waste watchers would alert customers of waste and provide conservation information. Four employees have been retained for the winter.

[1] May through December 1987.

measure. If necessary, some measures may be modified or other measures added to the program to maintain its effectiveness.

The current water conservation program is an expansion of Urban Water Management Plan program. It includes continuation of all previous water conservation efforts that are now supplemented with additional action elements intended to reduce the rate of increase in demand as the number of customers continue to increase. The current program is intended to establish or represent the "base case" for the many conservation actions already in place.

The present program involves both demand management (i.e., customer-related) and supply-side (e.g., leak detection and reclamation by the District) elements. The primary demand management elements are as follows:

- Device Distribution — Provide free devices for all existing customers to retrofit showers and toilets.
- Water Audits — Offer to review indoor water use of any customer and commercial/industrial processes to suggest ways to improving water use efficiency.
- Water Efficient Landscapes — Promote use of low-water-consuming-plants and efficient irrigation for all existing customers through rebates and free consultation. Require these practices in new residential, commercial, institutional, and industrial, developments through enforcement of regulations or by offering incentives through a discount or landscape rebate program.
- Public Education — Expand current efforts and produce new exhibits, brochures, and school material to encourage efficient water use.
- District Activities — Reduce water use at District facilities and pursue pricing and pressure reduction policies to encourage conservation.

Regarding supply-side activities, EBMUD has continued to encourage water reclamation by proceeding with additional projects whenever they have been found to be technically and financially feasible. The District is also continuing its leak detection program and reclamation of water treatment plant backwash waters to further reduce losses in the distribution system.

The expanded or base case water conservation program has been designed to reduce demand by some 4.0 mgd compared to demand projected to occur without the "base case"

program in effect. Water savings, cost-effectiveness, impacts, and likelihood of success in selecting elements of the present program have been considered by the District. Table 7-3 shows the projected water savings, benefits, and costs from the expanded water conservation program.

The expanded water conservation program, created to maximize efficient use of the existing water supply system, may, as well, improve operational flexibility and slow, to some extent, the growing demand on the Mokelumne supply.

7.2 PROPOSED PROGRAM

In developing the Water Supply Management Program, the District has further evaluated the feasibility and practicality of expanding water conservation efforts beyond that contained in the present "base case" program. To this end, the District has compiled a list of water conservation measures extending beyond those contained in the Expanded Program. These measures were evaluated individually in terms of potential water savings, benefits, and costs. From this group of potential measures, plus measures contained in the existing program, several alternative programs were identified and evaluated.

7.2.1 ADDITIONAL CONSERVATION MEASURES

While the methods and technology are available to reduce water use, a major problem is determining the most appropriate method for implementing water conservation measures. For example, the District's demonstration gardens have shown that outside water use can be trimmed by 90%. To achieve this savings, the customer must be willing to spend time and or money to change their landscaping, know and understand the water needs of the plants, and actively control and monitor actual irrigation. As the District has water available in excess of its needs a majority of the time, the approach has been to select voluntary type measures that either have been shown to be successful or have potential for being successful.

The District's role in promoting and encouraging water conservation, short of a critical situation such as a drought, is limited to educating customers, and providing information

TABLE 7-3
PRESENT WATER CONSERVATION PROGRAM
(Base Case)

MEASURE	TYPE OF USE AFFECTED	BENEFITS OF MEASURE	COSTS OF MEASURE	ESTIMATED ADDITIONAL WATER SAVINGS IN 2020	CUSTOMER/COMMUNITY RESPONSE	COMMENTS
<u>DISTRICT IN-HOUSE MEASURES</u> <u>Leak Detection and Pipeline Rehabilitation</u>						
• Leak detection crews survey approx. 300 miles per year. • Repair 600-800 leaks and breaks per year. • Replace approx. 7.5 miles of pipe per year due to poor condition.	Distribution System L:osses	• Minimize system losses (unaccounted-for water). • Maintain integrity of distribution system.	• Leak Detection: $600,000 p.a. • Pipeline repairs: $1,700,000 p.a. • Pipeline replacements: $4,100,000 p.a.	• NO ADDITIONAL WATER SAVINGS. • Approx. 0.5 to 1.5 MGD saved each year; this savings is not cumulative. • Continuation of program will maintain a low rate of unaccounted-for water losses.	• Customer reported leaks are repaired promptly. • District notifies customers of customer side leaks.	• Continuous effort required to maintain long-term integrity distribution system.
<u>Water Metering</u>						
• All customers metered. • All District facilities metered. • Routine inspection, testing and repairing of meters. • Past and present water use shown on customer bills.	All Water Use	• Equitable collection of revenues. • Reduces overall water consumption. • Provides means for identifying leaks on customer's side of meter. • Reduces accounted-for losses due to inaccurate meters.	• $400,000 p.a. spent on new water meters. • $1,300,000 p.a. spent on inspecting and repairing meters.	• NO ADDITIONAL WATER SAVINGS. • Actual quantity of water saved is unknown. • Nation-wide studies indicate 20% water savings when metered.	• No adverse customer response to metering. • Assists customer in locating leaks.	• Standard District practice since 1923.
<u>LONG-TERM CONSERVATION PROGRAM</u> <u>Water Savings Device Distribution</u>						
• Distribute free retrofit kits to customers. • Kits include: low flow showerhead; toilet displacement bag; dye tablets. • Approx. 20,000 kits distributed per year.	Residential Inside Use	• Devices have potential to save up to 9.8 gpcd (or 23.0 gpd/SFDU and 17.6 gpd/MFDU in 2020). • Low flow showerhead also saves energy due to reduced hot water usage.	• No cost to customers. • Kits cost District $3.00 each, or approx. $60,000 p.a. • Total program cost is approx. $72,000 p.a.	• PROJECTED SAVINGS: 1.9 MGD • Water savings from kits already distributed is unknown.	• Customer satisfaction with kits is unknown. • Actual installaiton rate and life of kits is unknown.	• Requires continuous effort by District to maintain level of usage. • Water saving potential significantly reduced when installed in homes built after 1978.

TABLE 7-3 continued

MEASURE	TYPE OF USE AFFECTED	ESTIMATED BENEFITS OF MEASURE	ESTIMATED COSTS OF MEASURE	ESTIMATED ADDITIONAL WATER SAVINGS IN 2020	CUSTOMER/COMMUNITY RESPONSE	COMMENTS
<u>Water Audits</u>						
• Program initiated in 1986. • 100 water audits performed. • Anticipate 200 audits per year.	MF Residential Comm & Inst. Inside & Outside Use	• Recommend methods of improving water use efficiency. • Identify opportunities to save water. • Identify potential leaks.	• District cost of program estimated to be $40,000 p.a., primarily staff time. • Modifications made by customers may have some cost; this assumed to be offset by cost savings.	• PROJECTED SAVINGS: 0.9 MGD. • Savings from program to date is unknown.	• Customer response to District recommendations is unknown.	• District is monitoring the response to the program; no conclusions can be drawn at this time.
<u>Landscape Consultations</u>						
• Program initiated in 1987. • Approx. 500 landscape consultations. • Anticipate 100 consultations per year.	Residential Outside Use	• Recommend plants and materials for reducing outside water use. • Review landscape plans and provide advice.	• Estimated total cost to District is $17,000 p.a. • High customer costs due to re-landscaping; assume decision to relandscape and decision to use low water using materials is separate decision.	• PROJECTED SAVINGS: 0.1 MGD. • Water savings from program is uncertain.	• Customer response to program is unknown.	• District is monitoring the response to the program; no conclusions can be drawn at this time.
<u>Landscape Water Use Efficiency in New Developments</u>						
• EBMUD established model guidelines for cities and counties to adopt. • Contra Costa County and cities of Albany, Danville, El Cerrito, Piedmont, and San Leandro have adopted modified guidelines.	New Developments Outisde Use	• Requires new developments to conform to specified guidelines for landscaped area. • Reduce outside water use by estimated 25%.	• Unknown administrative costs to be borne by cities and counties adopting guidelines. • District cost estimated to be $30,000 p.a..	• PROJECTED SAVINGS: 1.1 MGD. • Actual water savings is unknown; guide-lines have just been implemented.	• Guidelines not in effect long enough to determine response.	• Other cities are considering guidelines and may adopt them in the future.
<u>PUBLIC INFORMATION</u> <u>Demonstration Gardens</u>						
• Construct approx. two demonstration gardens per year in cooperation with other agencies.	Outside Use	• Demonstrate the attractiveness, low maintenance and low water use of drought tolerant landscaping.	• Construction of two gardens per year estimated to cost $25,000 p.a. • Sponsoring agencies would be responsible for operation and maintenance of gardens.	• NO ADDITIONAL WATER SAVINGS. • Gardens are for demonstration pur-poses; no water sav-ings are attributed. • Gardens have demonstrated a potential for 90% water savings in outside use.	• Public agencies are supportive of gardens.	

TABLE 7-3 continued

MEASURE	TYPE OF USE AFFECTED	ESTIMATED BENEFITS OF MEASURE	ESTIMATED COSTS OF MEASURE	ESTIMATED ADDITIONAL WATER SAVINGS IN 2020	CUSTOMER/COMMUNITY RESPONSE	COMMENTS
Public Information & School Education • Landscape Book and Brochure. • Landscape Video. • Exhibits. • Speakers Bureau. • Educational Software. • Water Conservation Activity Center.	All Water Use	• Provide information on efficient water use. • Informs customers of observation assistance available through other programs.	• Total District cost is estimated to be $75,000 p.a.	• NO ADDITIONAL WATER SAVINGS. • Water savings from public information is not quantifiable.	• The District has received positive response from past public information and education efforts.	• Public information and education is a necessary element of any balanced conservation program.

on and incentives to saving water. The District's approach is to assist customers in achieving efficient use, and allowing the customer to determine to what extent they will conserve.

Table 7-4 presents a summary of additional water conservation measures that have the potential for water savings and are considered by the District to be practical and acceptable. In summary, the proposed water conservation program, which includes the Base Case plus the additional measures indicated in the table, is estimated to provide 7.0 mgd of water savings by 2020. Again, due to the uncertainties involved, these savings are speculative, and it may be impossible to accurately predict or even assess actual water savings until the program is implemented. The total annual cost of this water conservation program is estimated to be about $545,000 per year.

The measures listed in Table 7-4 represent means of implementing additional water conservation actions. They can be voluntary or mandatory, encompassing specific water saving devices through general guidelines on efficient water use. These measures would supplement, or in some cases replace, those measures contained in the Expanded Water Conservation Program.

7.3 ALTERNATIVES

The goal of assuring that the District has sufficient water supplies to meet the reasonable demands of customers is the basis of assessing the merits of further water conservation measures. The purpose of the District's conservation programs has been to assure that customer demand is reasonable and to avoid waste. In most years (nine out of 10) the Districts water supplies are more than sufficient to meet customer demand. However, climatic patterns occasionally result in dry periods in which available supply is insufficient to meet demand. It is not reasonable, nor feasible, to assure that 100% of customer water need is met 100% of the time. In 1985, the District adopted a policy on Water Supply Availability and Deficiency which established criteria in which, during infrequent dry periods, insufficient water supplies would be met by cutbacks in customer demand. The District linked water availability to both long-term conservation and short-term demand reduction measures. One effect of a long-term conservation program is to reduce the District's ability to respond to a drought with short-term demand reduction measures. This raises two alternative approaches to water conservation, both of which are widely advocated.

TABLE 7-4
ADDITIONAL WATER CONSERVATION MEASURES

MEASURE	TYPE OF USE AFFECTED	ESTIMATED BENEFITS OF MEASURE	ESTIMATED COSTS OF MEASURE	ESTIMATED ADDITIONAL WATER SAVINGS IN 2020	CUSTOMER/COMMUNITY RESPONSE	COMMENTS
<u>Expansion of Water Saving Device Distribution</u>						
• Increase distribution of retrofit kits from 20,000 per year to 30,000 per year. • Kits include: low flow showerhead; toilet displacement bag; dye tablets • Increase door-to-door distribution of kits.	Residential Inside Use	• Devices have potential to save up to 9.8 gpcd (or 23.0 gpd/SFDU and 17.6 gpd/MFDU in 2020). • Low-flow showerhead also saves energy due to reduced hot water usage.	• Customers would continue to receive kits free of charge. • Retrofit kits cost the District $3.00 each for an increased cost of $30,000 p.a. for the kits. • Total program costs estimated to be $117,000 p.a., an increase of $45,000 p.a.	• PROJECTED SAVINGS: 0.9 MGD • This is the incre-mental savings from expanding the program; total from device distribution would be 2.7 MGD.	• Same as current program.	• Same as current program.
<u>Water Audits for Industrial Processes</u>						
• Expand water audit program to include industrial processes. • Anticipate 100 industrial audits per year. • Emphasis would be on installing low water use equipment for sanitary, cooling and process use. • Audits would include water, wastewater and energy (as appropriate).	Industrial Inside Use	• Industrial customers tend to use large quantities of water; therefore a relatively small number of audits could result in high water savings.	• District costs for this program are estimated to be $75,000 p.a., primarily staff time. • Customers may be faced with costs to modify processes however, these costs are assumed to be offset by cost savings.	• PROJECTED SAVINGS: 1.1 MGD • Water savings resulting from industrial water audits would be estimated on an individual basis.	• Industrial customers have demonstrated a willingness to reduce water use when overall cost savings can be achieved.	• Long payback periods for process modifications may affect customer response.
<u>Landscape Consultations</u>						
• Expand current Landscape Consultation Program to non-residential customers. • Anticipate 200 consultations per year. • Landscape consultations would be similar to water audits but would focus on outside water use.	Non-Residential Outside Use	• Target larger landscape areas where potential water savings would be greater. • Provide information on plants and materials, irrigation systems, etc. • Review landscape plans and make recommendations.	• District cost for this program is estimated to be $38,000 p.a., an increase of $21,000 p.a. over the current program. • Customers would have landscaping costs, but these are assumed not to increase to use of low water use plants and materials.	• PROJECTED SAVINGS: 0.2 MGD • This is the incremental savings from expanding the program; total from landscape consultations would be 0.3 MGD.	• Customer response to this program program is unknown.	

TABLE 7-4 continued

MEASURE	TYPE OF USE AFFECTED	ESTIMATED BENEFITS OF MEASURE	ESTIMATED COSTS OF MEASURE	ESTIMATED ADDITIONAL WATER SAVINGS IN 2020	CUSTOMER/COMMUNITY RESPONSE	COMMENTS
Irrigation Management						
• Encourage irrigation of large landscaped areas to be scheduled using ET data. • District would conduct training seminars for landscape maintenance personnel.	Non-Residential Outside Use	• Increase irrigation efficiency without changing landscapes.	• District costs estimated to be $10,000 p.a. to conduct training seminars. • Customers would incur minor costs in training landscape maintenance personnel.	• PROJECTED SAVINGS: 0.7 MGD	• Customer response to program is unknown.	• District maintains a weather station which can provide real-time evapotranspiration data to landscape personnel.
Additional Demonstration Gardens						
• Develop 4 (rather than 2) demonstration gardens in public areas each year. • Work with local public agencies to encourage use of low water landscaping in public areas.	Outside Use	• Demonstrate attractiveness and low maintenance of low water using landscapes.	• Construction of four gardens per year estimated to cost an additional $25,000 p.a. • Sponsoring agencies would be responsible for operation and maintenance costs of gardens.	• NO ADDITIONAL WATER SAVINGS. • Gardens are for demonstration purposes; no water savings are atributed.	• Public agencies have been supportive of gardens.	
Landcape Rebate: Pilot Program						
• Pilot program to encouarge use of low water using landscapes by existing customers. • Offer rebates for customers who meet District criteria.	Existing Customers Outside Use	• Encourage customers to choose low water using plants when relandscaping. • Reduce outside water use.	• Pilot program would last for 2 to 3 years. • District costs estimated to be $120,000 p.a.	• NO ADDITIONAL WATER SAVINGS. • No water savings are attributed to the pilot.	• Pilot program would test public responsiveness to incentives to encourage low water landscapes.	• Program assumes customers have already decided to modify existing landscapes.

Before selecting the water conservation measures shown in Table 7-4, the District reviewed the results of its present program, customer response to the shortages of 1976-77 and 1986-87 and information on other water saving devices and programs. Two approaches were evaluated. The first would involve intense conservation measures designed to reduce water use in all years whether a shortage is in effect or not. The second approach would involve moderate conservation measures designed to reduce water use in all years with more intense demand management during droughts. The District concluded that the first of the two approaches is unproven in that it would rely on devices and actions untried on a large scale, and it would also require life-style changes on the part of some customers. The second approach was selected because it has been demonstrated to be workable. EBMUD customers respond well to the need to conserve during relatively rare periods of water deficiency. More specific conclusions of the District's study were:

- Water conservation programs are not directly comparable to a new water storage reservoir or a connection to a new source of supply, since they take years to implement, have unproven and uncertain success, and are difficult to quantify.

- It is unreasonable to assume that measures that have not been demonstrated in the District or on a large scale in other locations are currently feasible and assessable alternatives, i.e., the cost of a 1.5-gallon-per-flush toilet is not readily determinable, particularly when retrofitted in individual homes, nor is it possible to determine what the health authorities would require to allow the installation of a dual distribution system in apartments, hotels or even individual houses.

- In assessing how much water might be saved by these measures, it is difficult to predict the quantity since accurate data except on small-scale demonstration programs for specific appliances like low-flow showerheads, are not available.

- There are social and economic impacts, many of a non-quantifiable nature, of various water conservation measures, e.g., many District residents of multi-family and single-family homes, as well as users of institutions such as the University of California, enjoy the effects of large areas of greenery. Although considerable water savings can be achieved, those measures which could substitute water conservation for major water supply development would have the effect of changing the appearance of EMBUD's urban landscape.

- The availability of adequate supplies of fresh water is a key factor in maintaining a strong existing economy as well as development and redevelopment of a region. The prosperity of the East Bay depends upon an adequate water supply that is perceived to be adequate. If the District undertakes an aggressive series of intense water conservation measures more rigorous than those employed in the United States generally or in Northern or Southern California in particular, the area would be perceived as having a long-term water deficiency. It is unlikely that this would have a positive effect on the region's economy.

- There appears to be a water rate effect of water supply shortage. The Marin Municipal Water District's water rates are almost double the average of the Bay Area and significantly higher than EBMUD's rates. This appears to be due to an intentional policy to delay the construction of new water supply facilities; when such facilities are constructed they have been relatively small compared to demand. As counterpoint, water rates to District users are more economical through construction of large facilities that ultimately have low unit costs.

7.4 ENVIRONMENTAL OVERVIEW

7.4.1 POTENTIAL IMPACTS

The additional water conservation measures that have been proposed and evaluated represent no direct adverse impact on environmental resources of the area. The measures would be beneficial in that they would delay by several years the need for new water sources. A slightly larger number of homes or businesses could be supplied from the present water sources. Somewhat more water would remain in the Mokelumne River for in-stream uses or downstream diversion.

A potential disadvantage of the additional water conservation measures is that they might possibly make water management during droughts more difficult. If a household does not exert much effort to save water during periods of normal supply, during periods of drought it can relatively easily change a few water-wasting habits and cut its water use. On the other hand, in a household that routinely saves water, there is little more that can be saved during a drought, and its water use remains roughly the same. If an entire community saves water routinely it is apparent that little more can be done during a drought. Even a small shortfall in water availability might then cause considerable inconvenience to the community as a whole.

Neither potential beneficial nor adverse environmental impact of the proposed additional water conservation measures by themselves or in association with the present "base case" water conservation program are deemed to be significant.

7.4.2 SUGGESTED MITIGATION MEASURES

As no significant adverse environmental impacts have been identified with the additional water conservation program measures, mitigation measures are not suggested.

8 WATER RECLAMATION

8.1 SETTING

8.1.1 BACKGROUND

Water reclamation is the treatment of water that has been used once for some previous purpose so that it can be used again. While it is technically feasible to reclaim municipal wastewater for drinking, it is not acceptable to regulatory agencies concerned with public health. They believe that the risks associated with human consumption of reclaimed water, however slight, should not be taken when other alternatives are reasonably available. As a consequence, most water reclamation projects are designed to produce water for a use that has less demanding quality requirements than drinking water supply.

Water reclamation is useful to EBMUD because any demands that can be met with reclaimed water represent a reduction in demand that must be met with high quality water and thus the need for additional supply can be delayed. The District has explored the possibility of large-scale wastewater reclamation in recent years. However, opportunities for water reclamation are limited by its high cost and the distance between the District's wastewater treatment plant in Oakland and larger potential users. Several small projects have been implemented that save an average of about 4.5 mgd of potable water. It is worth noting that the wastewater that is reclaimed does not have to come from EBMUD for the benefits of reclamation to be realized. Reclamation of wastewater from any treatment plant within the District's boundaries serves to reduce the overall demand for high quality water.

8.1.2 EXISTING RECLAMATION PROJECTS

The District's principal water reclamation projects and their annual water savings are listed in Table 8-1. They include the following:

TABLE 8-1

WATER RECLAMATION PROJECTS

Existing	Proposed
EBMUD Special District 1 wastewater treatment plant - landscape irrigation, general washdown, and industrial cooling (1.5 to 2.0 mgd)	Galbraith Golf Course - irrigation water from San Leandro wastewater treatment plant, to start in summer 1988 (0.15 mgd)
EBMUD filter plants (water treatment) - reclamation of filter backwash water (2.0 mgd)	Chevron Oil Refinery, Richmond - cooling water from West Contra Costa Sanitary District treatment plant; pilot study completed; estimated startup in 1991 (potential 4.7 mgd)
Richmond Golf Course - irrigation water from West Contra Costa County Sanitary District treatment plant (0.16 mgd)	San Ramon Valley - irrigation water from Dublin San Ramon Services District treatment plant; planning study (potential 1.4 mgd)[1]

[1] The market for reclaimed water in the San Ramon Valley is uncertain. The implementation date of this project is unknown. Accordingly, estimates of future demands do not assume this project will be implemented.

Special District No. 1

In 1971, the District constructed a process water plant at Special District 1 to provide tertiary treatment of wastewater for on-site irrigation and plant washdown uses. The plant, with capacity to treat up to 1 mgd, has an average annual production of 0.54 mgd (about 60 acre-ft./yr.). In addition, secondary effluent is used for industrial cooling of both a power generation station and compressors at an oxygen production plant. The quantity of secondary effluent reused is presently on the order of 1.5 to 2.0 mgd (around 2,000 acre-ft./yr.).

Filter Plant Washwater

Facilities for reclaiming filter backwash water from the District's filter plants were constructed in the late 1970s in compliance with federal discharge requirements. Four of the six filter plants recycle clarified overflow back through the normal treatment process in lieu of discharge. This option can also be exercised at the Orinda Plant, although reclaimed washwater is normally discharged to San Pablo Creek thereby replenishing San Pablo Reservoir. Operation of these facilities saves the District approximately 2.0 mgd of water.

Richmond Golf Course

In 1984, the West Contra Costa Sanitary District (WCCSD) began supplying reclaimed wastewater for summertime irrigation on 150 acres of the Richmond Golf and Country Club. This has resulted in an estimated average annual consumption of 0.16 mgd (about 185 acre-ft./yr.), while peak monthly use during the irrigation season reaches in excess of 0.6 mgd.

8.1.3 PRICING POLICY

In the past, EBMUD has addressed pricing of reclaimed water on an individual basis, because each project has been unique in terms of its source, treatment requirements, and the District's role in implementation. Prices have been established based primarily on recovery of costs, thus allowing price to be lower than the price of additional potable water and providing incentive for using reclaimed water. Such policy may not be as effective when higher water quality requirements necessitate higher treatment costs.

In order to keep the price of reclaimed water competitive with potable water, a Water Conservation and Development Fund is now in use to assist capital financing for future construction projects. This new policy provides a more standardized approach for reclaimed water price while still basing it on the unique water quality and operational factors of each project. The primary goal is to recover District cost to the extent possible without increasing overall cost to the user. The policy also states that when reclaimed water is available, and suitable for use, it should be substituted for potable water in non-potable applications.

An integral element of the proposed WSMP will be to further study and revise current pricing policy for reclaimed water in order to increase user incentive while providing an alternative yet competitive product to the potable supply.

8.2 PROPOSED WATER RECLAMATION PROJECTS

The water reclamation projects proposed as part of the WSMP are listed in Table 8-1. They are as follows:

8.2.1 CHEVRON OIL REFINERY

The biggest potential savings of potable water would be through a reclamation project at Chevron USA's Richmond oil refinery. Reclaimed wastewater from West Contra Costa Sanitary District could replace 4.7 mgd (5260 acre-ft./yr.) of potable water currently used for cooling. A pilot study was recently completed which demonstrated the effectiveness of advanced wastewater treatment in producing a water suitable for this purpose. The project report, to be completed in 1988, will provide design criteria and preliminary cost estimates. It is expected that the reclaimed water will cost approximately $415 per acre-ft. in 1990 dollars.

8.2.2 GALBRAITH GOLF COURSE

In January, 1987, a facilities plan for the Galbraith Golf Course Project was completed. The plan identified project requirements and evaluated alternatives to reclaim up to 0.15 mgd (160 acre-ft./yr.) of secondary effluent from the San Leandro Water Pollution Control Plant for irrigation of 110 acres. The recommended project has a construction cost of $323,000. Approximately half of this amount is expected to be funded by a low interest state loan.

The District is proceeding with design of the facilities required for this project, in order to meet project deadlines required by the loan program. It is expected that delivery of reclaimed water will begin in the summer of 1988.

8.2.3 SAN RAMON VALLEY

In August, 1983, EBMUD, Dublin-San Ramon Services District and Alameda County, jointly sponsored a study to investigate the potential for water reclamation in the San Ramon Valley. The market survey identified 18 potential irrigation sites totaling 850 acres, including golf courses, greenbelts, parks and schools. The recommended project limited irrigation sites to eight, totaling 488 acres (parks and schools were eliminated because a higher level of treatment is required at a subsequently higher cost). This project has the potential to save the average annual demand for potable water in EBMUD's service area by 1.4 mgd (1,630 acre-ft./yr.).

Economic feasibility is contingent on selection of a project by the local wastewater management agency to dispose of highly treated wastewater to local creeks. The local agency, the Tri-Valley Wastewater Authority (TWA) and EMBUD, would be responsible for the majority of the treatment and transport costs required for reclamation because these costs would also serve the disposal objective. EBMUD's costs would also include the lateral pipelines and pumping plants needed to serve individual users.

It is now apparent that TWA will be proceeding with an alternative wastewater disposal project. This directly affects the District's decision to proceed with reclamation because all treatment and transport costs would be the District's responsibility alone. The result would be an increase in the cost of reclaimed water to about $1,000/acre-ft. These costs are compared to a current potable water cost of $309/acre-ft.

As a result, this reclamation project is unlikely to be implemented during the earlier years of the WSMP. Continued study and investigation of potential reuse markets in the San Ramon Valley will, however, be undertaken by the District during the next few years.

8.3 ENVIRONMENTAL IMPACTS AND MITIGATIONS

The proposed water reclamation projects are a continuation of recent reclamation actions undertaken by the District. Existing reclamation projects save the District approximately 5 mgd of potable water. The proposed projects may save another 5 to 7 mgd of freshwater supply.

The proposed water reclamation projects would have a beneficial impact on the environment in that they would increase the efficiency of urban water use and reduce the demand on the District's sources. By reducing the need for fresh water diversion from the Mokelumne River, more water can be released downstream with consequent benefit to in-stream uses.

As more reclamation projects are implemented, particularly for large users such as golf courses or a refinery, the District benefits from greater flexibility in operating its potable water supply system. In the event of drought, reclaimed water users also benefit as they are not faced with the consequences of a water shortage. There can, however, be a adverse consequence. As water use efficiency increases through increased water reclamation, there is somewhat less surplus in the supply system from which to cut back from during droughts. Future cut-backs may be more difficult and troubling to consumers.

The site-specific effects of individual water reclamation projects are not addressed in this document. They will be addressed in individual documents for each project as they are implemented. No adverse environmental impacts would be expected with properly situated wastewater reclamation projects.

9 WATER QUALITY PROTECTION

9.1 BACKGROUND

Provision of the best quality water available to its customers has been, and continues to be, one of EBMUD's goals. It is a goal consistent with the California Department of Health Services long-standing policy that:

> "Water utilies should seek to obtain the cleanest water source practical and provide all reasonable protection of the supply from any known or potential source of contamination hazard."

Because most of EBMUD's water originates as snowmelt in the lightly developed Mokelumne River watershed, it is of very high quality. Its quality is protected by management of land use in the Mokelumne and terminal reservoir watersheds and by treatment at one of six filter plants. The quality of water supplied to EBMUD's customers exceeds the quality requirements of State and federal regulatory agencies.

Drinking water requirements are currently in a state of flux. Regulators are imposing increasingly stringent standards in response to federal and State legislative directives and as information on the health effects of various chemicals accumulates. In the future, many water agencies including EBMUD may have to alter their water quality management activities to meet the new standards.

Several water quality issues and concerns that are of importance today are discussed briefly below as a preface to the discussion of proposed actions.

9.1.1 WATERSHED PROTECTION

EBMUD protects the quality of its water supply by monitoring and controlling activities that could lead to contamination within the watersheds of both the Sierra source and its five terminal reservoirs in the hills of the East Bay.

These activities have included reacting to land use decisions being considered by the cities of Orinda and Moraga and the Counties of Contra Costa, Alameda, Amador and Calavaras (where potential development on adjoining lands could create sources of contamination) as well as an effective watershed management program that assumes maximum protection of the supply source. Further expansion of this program that includes additional land acquisitions is required in order to maintain the standards previously established.

9.1.2 TREATMENT AND DRINKING WATER STANDARDS

The 1986 amendments to the federal Safe Drinking Water Act will also have major impact on water purveyors. The Environmental Protection Agency (EPA) is currently preparing new regulations to implement the amendments, which will place emphasis on reduction of organic chemicals in drinking water, filtration of surface supplies and disinfection of all supplies. It is anticipated that the requirements will continue to become more complex in the future, as analytical techniques improve and more compounds are discovered that are of potential public health significance.

Merely meeting current standards does not assure that public health requirements will be met in the future. Further treatment improvements are expected and represent a part of the proposed WSMP.

Probably most significant known health risks in treated surface supplies are caused by suspected cancer-causing compounds known as trihalomethanes (THMs) that result from the disinfection of water with chlorine, which reacts with some naturally occurring organics to form THMs. There is serious consideration within EPA to lower the current standard for THMs from 100 micrograms per liter (ug/l) to something within the range of 10 to 50 ug/l. Water quality monitoring by the District from 1983 through 1986 showed average THM formation potential to be 51 ug/l at Pardee Reservoir and 46 ug/l at Nimbus on the American River, compared with 175 to 180 ug/l in the Delta.

The use of ozone or chloramines for disinfection instead of chlorine reduces THM formation. The first step in analyzing such a substitution at EBMUD will be pilot testing and preliminary design of new facilities and equipment. This work is part of the proposed WSMP.

9.1.3 TASTE AND ODOR

Although not a health concern, taste and odor are an aesthetic quality in water. The District's terminal reservoirs have been subject to periodic episodes of a detectable "earthy-musty" taste and odor caused by algae growth in warmer months. This problem has been controlled by treatment and careful selection as to the depth of withdrawal from the reservoirs. Further improvements to reduce taste and odor are a part of the WSMP.

9.1.4 USE OF DELTA WATER

During the 1976-1977 drought the District used Delta water which was pumped from Middle River, mixed with existing supplies, and served to all EBMUD customers. Significant taste and odor problems resulted when Delta water entered the San Pablo and Upper San Leandro Reservoirs and became about one-third of the total storage. In addition, THM levels caused by bromides from the Delta source (due to sea water intrusion) more than doubled, requiring about six years to flush out. Brominated THMs are currently suspected to be more potent as carcinogens than chlorinated THMs.

The drought experience showed that the introduction of any significant quantity of lower quality Delta water into the District's water system in the future would necessitate substantial modifications and rebuilding of EBMUD's filter plants. The proposed program includes study and design of treatment plant improvements and water quality monitoring practices to enhance flexibility and reliability during drought or emergency outage conditions.

9.2 PROPOSED ACTIONS

As an initial step in the program, EBMUD intends to further its water quality protection activities through both watershed management and treatment process improvements. This element of the Program is an expansion of the agency's current monitoring, watershed control and treatment plant improvement activities.

9.2.1 LAND ACQUISITION

The District's ability to effectively manage watershed lands as natural buffers for its terminal reservoirs is increasingly threatened by encroaching residential development. A watershed peripheral encroachment management plan has been proposed to ensure the

future security of the District's terminal reservoir watersheds in their role of protecting water quality.

Several land acquisitions are proposed. These include the purchase of 208 acres of private property for an estimated cost of $1.6 million in the San Pablo watershed basin, 723 acres of private property at an estimated cost of $4.8 million in the Briones watershed, and 498 acres of private property at an estimated cost of $3.0 million in the Upper San Leandro watershed.

In addition, contingent acquisitions have been recommended if an additional terminal reservoir project is approved. To ensure complete control of land use practices within the proposed Buckhorn watershed would require purchase of an additional seven parcels totaling approximately 678 acres at an estimated cost of $2.5 million.

Similar water quality protection of the proposed Pinole Reservoir would necessitate initial acquisition of 1,580 acres of watershed land at an estimated cost of $9.5 million, followed by additional purchase of 1,100 acres at an estimated cost of $6.6 million. Additional land acquisition to ensure comparable water quality control through watershed management for a proposed Los Vaqueros Reservoir would not be required.

Other lands needed to protect water quality may have to be acquired in the future.

9.2.2 LAND MANAGEMENT

A high quality water supply has been achieved, in large part, by protection of the largely undeveloped 575 square mile Mokelumne River watershed above Pardee Reservoir. Land use management has involved erosion control, vegetation removal and replanting, livestock grazing, fencing, specific use prohibitions (i.e., body contact recreation) and other measures in accord with present land use master plan policies and the adopted rules and regulations pertaining to effective watershed management. Only those activities which are compatible with water quality preservation are permitted within the watershed. Effective land use management has reduced the risk of all sources of contaminants that might possibly be introduced by upstream agricultural, industrial and municipal activities.

The ongoing land use management measures carried out by EBMUD within the Mokelumne watershed will be continued in the WSMP in order to maintain a low contamination risk potential to the principal source of supply. The District will also continue to work closely with local health departments to prevent potential contamination on the watershed.

Land management also involves effective access control to all activities on EBMUD'S local watersheds, in order to further protect quality of water stored within the agency's five East Bay hills terminal reservoirs. Present access control measures (i.e., surveillance/reconnaissance) will remain an integral part of the WSMP.

Erosion control measures will also be part of the proposed program. Facilities are now constructed to repair erosion gullies and prevent further erosion; more will be put in place in coming years. Silt retention structures have been built to protect the reservoirs from sedimentation; additional structures will be constructed in the future. Continued protection of these lands will involve redesign of some trails and fire roads in order to minimize potential erosion and subsequent siltation of the reservoirs. The District also works closely with both Alameda and Contra Costa Counties to assure that road construction and land grading activities do not create further erosion. Continued participation with the counties in pursuing development of their general plans on watershed lands will be part of the proposed program.

The program also includes a variety of vegetation management measures including fire control, use of goats, mechanical vegetation removal and livestock grazing. Livestock are only permitted at conservative grazing rates, with all riparian corridors and reservoirs fenced. The present grazing program would be continued in order to maintain low forest fire potential on 36,000 acres of District rangeland. In addition, further land use management actions to prevent forest fires by removal of dry growth will be pursued.

The District patrols its watershed areas on a daily basis to detect fires, discourage trespassers, and regulate leaseholders. The basic purpose of this reconnaissance is to prevent fires, control erosion and maintain water quality. The East Bay Regional Park Police are under contract to provide law enforcement surveillance to watershed areas open to the public. All major projects proposed within the watersheds or adjacent to EBMUD property are reviewed in order that possible influence on watershed lands can be assessed.

The District will continue to conduct routine field reconnaissance surveys of watershed lands. The District will also keep abreast of potential sources of contamination by maintaining close contact with local officials.

9.2.3 TREATMENT IMPROVEMENTS

The treatment improvement component of the WSMP is designed to:

- Improve product water quality to meet future drinking water regulations and lower risks to public health;
- Improve the taste and odor of product water;
- Improve treatment operations in terms of flexibility (e.g., ability to meet demand from more than one plant when needed), reliability and cost.

The District's seven treatment plants range in age from 21 to almost 100 years. All of the plants have manual operation with no continuous water quality or process monitoring and some contain an assortment of outdated and unreliable equipment. As a result, operators have to make numerous adjustments when flow or raw water quality changes, which leads to occasional variations in treated water quality and interruptions of service.

Improvements planned to correct these deficiencies at the treatment plants include improved chemical storage and feed systems, continuous water quality monitoring, solids handling improvements and better control of plant processes through a computer based control system, OP/NET. The estimated cost for these projects is $18.0 million, in 1988 dollars.

The terminal reservoir supplies are subject to periodic episodes of severe taste and odor which were especially evident during the summer of 1987. During July, August, and September, there were 411 complaints in the Richmond/Hercules and Castro Valley areas due to taste in the water versus 32 in the rest of the District. While not a specific health concern, minimizing taste and odor is extremely important in providing District customers with the highest water quality possible.

To minimize taste and odor in the future, granular activated carbon is scheduled to be installed in the filter beds at the Sobrante and Upper San Leandro Filter Plants by June

1988. The cost of this project is estimated to be $2 million. Taste and odor could be further controlled by ozonation. Pilot testing and design of ozonation facilities at Upper San Leandro and Sobrante Filter Plants are part of the WSMP.

EPA regulations, as currently proposed, would require changes to the District's water disinfection practices. The rules would require the use of ozone and chloramines for disinfection instead of chlorine. Preliminary estimates of the cost to retrofit all of the District's plants with ozone and chloramine feed facilities are $26 million in 1988 dollars.

More drinking water regulations are expected in the coming years. The Safe Drinking Water Act Amendments of 1986 requires EPA to more than triple the number of regulated contaminants by 1989. Looking toward the future of water treatment, EBMUD is evaluating new treatment technologies, such as membrane filtration which is thought to remove turbidity, Giardia (a disease-causing organism) and other particles without the use of treatment chemicals.

9.3 ENVIRONMENTAL IMPACT AND MITIGATIONS

Protection of EBMUD's water quality through additional watershed source control and treatment plant process improvements is a continuation of past and present water quality monitoring and control activities that have been well established by the District.

In reviewing the potential effects of the proposed water quality protection measures on the natural resources and infrastructure of the region, no substantial adverse environmental impacts were identified. Enhanced water quality protection through the source control and treatment measures that have been proposed would be of benefit to both the water resources of the region and the public's health and welfare.

The site-specific impacts of treatment plant improvements cannot be analyzed until the improvements are defined in detail. Separate environmental documents would be prepared on future treatment improvement projects.

10 WATER SUPPLY AND URBAN GROWTH

10.1 INTRODUCTION

Section 15126(g) of the California Environmental Quality Act Guidelines requires that an EIR must contain a discussion of the growth-inducing impacts of a proposed project. Ways in which a proposed project could foster economic or population growth and so have a direct or indirect impact on the environment must be discussed. Actions that remove an obstacle to growth must also be discussed. The following paragraphs discuss the general relationship between infrastructure expansion and growth, the special circumstances of the WSMP and the overall consequences of growth in the East Bay.

10.2 INFRASTRUCTURE EXPANSION AND URBAN GROWTH

Many factors combine to cause growth in any particular area. Probably the two most important factors causing or restraining growth are market forces and community governments. Other factors, such as the availability of properly zoned land; sufficient water, wastewater, roads, schools and public safety services; and a pleasant climate all affect a region's growth rate to a lesser extent. The market expands basic industry (manufacturing, resource extraction, etc.) when it is possible for investors to make profits by doing so. Profits are possible when the cost of production and distribution from a manufacturing location are less than the price that can be obtained for the goods produced. The market also creates demand for housing when the local economy expands (new workers need homes) and interest rates are favorable for residential construction. The market further creates demand for service industries and retail goods when these new workers take up residence in a region.

Local governments influence growth by allowing or preventing construction in particular areas or in the entire community, by means of general plan land use policies. General plans indicate the population and level of economic activities that a community desires

and that can be comfortably supported taking account of land area and environmental constraints. After public review, plans and policies are adopted by elected officials; these officials reflect the will of the majority of community residents. These same elected officials approve or disapprove specific development proposals. Both the community's general plans and specific development proposals are subject to environmental review under the provisions of the California Environmental Quality Act.

Although market forces are the predominant influence on community growth, their effects on particular communities are not required to be examined as part of the environmental review process. Because community governments have the next most important effect on growth, the logical arena for discussion of growth and its impacts is a community's general plan EIR. It is the communities that decide where and how much growth is to occur via general plans and land use elements; citizens and interest groups and other governments have the opportunity to comment during the preparation and adoption of these plans and during the public hearings on their EIRs.

Once plans are adopted by a community, it is the mandate of public service agencies -- water and wastewater treatment agencies, school districts, police and fire protection departments, etc. -- to respond to the community's desires as expressed in the general plan. In order to plan for their own staffing and facilities, these agencies must consider the plans of the communities which they serve.

When service-providing agencies such as water agencies propose infrastructure expansion projects the proposed projects are subject to environmental review under the provisions of the California Environmental Quality Act. As noted earlier in this chapter one of the California Environmental Quality Act requirements is that the growth-inducing impacts of a proposed project be discussed in an EIR.

Two scenarios are worth examining. A community adopts a general plan that assumes a population of 100,000 in the year 2005 with a consequent water demand of 20 mgd. The existing water supply system can only supply 15 mgd and thus the responsible water agency proposes to increase its water treatment capacity to 20 mgd. It is clear that the water agency is expanding its capacity so that it will be able to meet the needs of the community as it grows in accordance with its agreed upon general plan. The water

agency's proposal could logically be regarded as growth-accommodating rather than growth inducing. The impacts of growth as described in the general plan EIR would have been considered by the community's elected officials before the general plan was adopted. It would be reasonable that the discussion of growth in the water system expansion EIR simply reference the general plan EIR.

Under the second scenario and assuming the same community, the water agency proposes to expand its capacity to 25 mgd despite a general plan population projection that corresponds with a water demand of 20 mgd. The water agency board of directors believe that, based on historic trends, water demand will grow more rapidly than projected because the general plan will be amended before 2005. Although provision of 25 mgd of water supply capacity will by no means guarantee the growth of population beyond the general plan target it could obviously support a higher population. A case can be made that the water system expansion is growth-inducing and the secondary impacts of the growth it might induce should be examined in the water system expansion EIR.

In reality, circumstances rarely fit neatly into the two scenarios. In EBMUD's case water is supplied to many cities and unincorporated areas in two counties. The general plans of these communities are in various states of evolution and only provide a partial picture of future population and employment in the District's service area. The projections made by the Association of Bay Area Governments, a regional council of local governments, provide an indication of a probable future but are not necessarily agreed upon by all local governments and are not subject to environmental review. In developing their own projects it was the District's intention that they reflect the plans of local governments in their service area. To do otherwise would be pointless because the District can only provide water to homes and businesses whose existence has been approved by local governments. It is true, however, that EBMUD's projections are an imperfect reflection of local government's intentions because in many cases local general plans are in a state of flux.

A final point to be made is that there is no evidence that the presence of abundant water inevitably causes growth. If it did we would expect the Pacific Northwest or Vermont and Maine to be growing rapidly; they are not. Growth is produced by a multiplicity of factors with water supply being only one of them. Even in the arid west abundant water does not

necessarily lead to rapid growth. The areas of California in the Colorado River basin have access to water but they remain lightly populated. On the other hand, there is no doubt that, without water, urban growth is not possible. In cases where the market and local governments both favor growth but it is constrained by lack of water, the provision of a new water supply removes an obstacle to growth.

10.3 GROWTH AND THE WATER SUPPLY MANAGEMENT PROGRAM

10.3.1 EBMUD'S OBLIGATION TO PROVIDE SERVICE

EBMUD is obliged to provide water to customers within its boundaries. The obligation to serve is not set forth specifically in statutory law. Rather, it derives from common law and is defined by an evolution of appellate court cases. In summary, the District has a duty to provide adequate and reasonably efficient service impartially, without unjust discrimination, and at reasonable rates to everyone within the service area who complies with the District's rules and regulations.

The District must provide a supply of water adequate to meet the reasonable needs of its customers. This does not require the District to meet excessive customer demands, nor does it preclude the District from modifying supply needs by means of conservation.

A principal feature of the obligation to serve concerns the liability of the District to extend its service facilities to accommodate new developments within its service area. The California Supreme Court has concluded that a water agency has the duty to "gradually extend its system as the reasonable wants of the growing community might require." It emphasized, however, that the duty to furnish service by an extension of the water system depends upon the reasonableness of the demand (Lukrawka v. Spring Valley Water Co., 169 G. 318).

For example, it is District policy that an unreasonable demand for service results if the District constructs major facilities needed to serve at no expense to applicants. The District, therefore, requires "that applicants for water service shall bear the cost of major facilities capacity which must be planned, designed, and constructed to provide that service" (Regulations Governing Water Service, Section 3B).

As a general rule, the District must treat equally all customers who are similarly situated. It cannot deny service to one customer which is given to another. However, discrimination among customers is permissible on the basis of a reasonable classification, so long as customers within the same classification are treated alike.

10.3.2 GROWTH PROJECTIONS

In order to be in a position to meet its obligation to provide service EBMUD must try to anticipate the land use planning decisions of the cities and counties in the area which it serves or is willing to serve. To do that, water supply facility planning is based on the District's ultimate boundary and sphere of influence, current general plans of the cities and counties, and on anticipated changes in the general plans as shown by amendments in process.

Longer range land use plans of property owners in the area EBMUD serves or is willing to serve are considered in planning significant water facilities if there is a reasonable expectation that such development will occur in the District's planning timeframe. In such cases the additional capacity for future development may be included only in certain near-term water facility projects, to take advantage of economies of scale and to avoid the adverse impacts of future parallel construction, with a need to construct local additional facilities in the future before water service could be provided.

EBMUD periodically reviews available projections and forecasts of population, housing, and employment from many sources. The sources of data used to estimate socioeconomic conditions in the EBMUD service area from 1985 to 2020 include the following sources:

- Association of Bay Area Governments (ABAG), Projections '83, '85 and '87.
- California Department of Finance (DOF) Reports 83 P-1 and 84 P-2.
- Data from cities, counties and other planning agencies in the EBMUD service area.

<u>ABAG's Projections</u>

The Association of Bay Area Governments periodically develops socioeconomic projections for the nine county San Francisco Bay region and for sub-regional divisions. Projections '83 includes projections from 1980 to 2000 of population, housing, and

employment for the nine-county region. Recently, ABAG released Projections '87 which include population, housing, and employment projections from 1980 to 2005. While Projections '85 and '87 were released after development of the water demand projections, the demand projections have been modified to reflect the current data. The ABAG projections are the principal source of socioeconomic data for EBMUD's projections from 1985 to 2000.

Department of Finance Reports

The population Research Unit in the California Department of Finance (DOF) periodically prepares and publishes housing and population projections by county. Report 83 P-1 provides population projections for all California counties from the year 1980 to 2020.

Report 84 P-2 and related backup material gives household projections for all California counties from the year 1980 to 2010. In determining the household population from the population projections described above, a distinction is made between the portion of the population living in group quarters (i.e, military barracks and college dormitories). The household population is obtained by subtracting the projected group quarters population from the total population.

Data from Other Planning Agencies

During 1985, EBMUD consulted with the planning agencies in each city and county in the EBMUD service area, except in the San Ramon Valley. The purpose of these consultations was to independently verify and update the ABAG projections. The interviews supported the accuracy of the ABAG projections for the most part, except for new developments in the planning stage since ABAG Projections '83 were released. The San Ramon Valley area was covered by a special EBMUD study in 1984 for the Environmental Impact Report prepared for the major facilities projects in the distribution system. In that study, specific recent development activity in the area was identified which were not accounted for in ABAG's Projections '83. Projections '85 also included recent development activity not accounted for in Projections '83. Differences between the '83 and '85 projections have been included in the water demand projections.

EBMUD also consulted with the planning departments of the Pacific Gas and Electric Company (PG&E) and Pacific Telesis. PG&E has prepared county-wide projections of population from the year 1980 to 2005. Projections have been estimated for smaller areas but on a much shorter term (approximately 10 years). Pacific Telesis does not prepare county-wide long-range projections. The data obtained were compared to the ABAG and DOF data.

The data gathered from the sources mentioned above were used to develop housing, population, and employment projections within EBMUD's service area from 1985 to 2020 for the seven sub-areas shown in Figure 10-1. Both high and low projections were made representing the maximum and minimum levels of growth. ABAG has indicated that: "As a reference, Projections '83 would represent the upper bound of a forecast range. That is, at least at the regional level, expected growth should not exceed the levels identified in this publication. This is based on current information and may clearly change in the future." DOF data for Alameda and Contra Costa Counties closely agrees with ABAG data for 1980 to 2000. Housing, population, and employment projections obtained using the ABAG and DOF data were assumed to be the upper bound or high projection. The low projection was obtained by assuming that the housing, population, and employment growth estimated by ABAG would occur at a lower rate. Figure 10-2 shows projections for housing, population, and employment, respectively, within EBMUD's ultimate boundary.

10.3.3 GROWTH IMPACTS

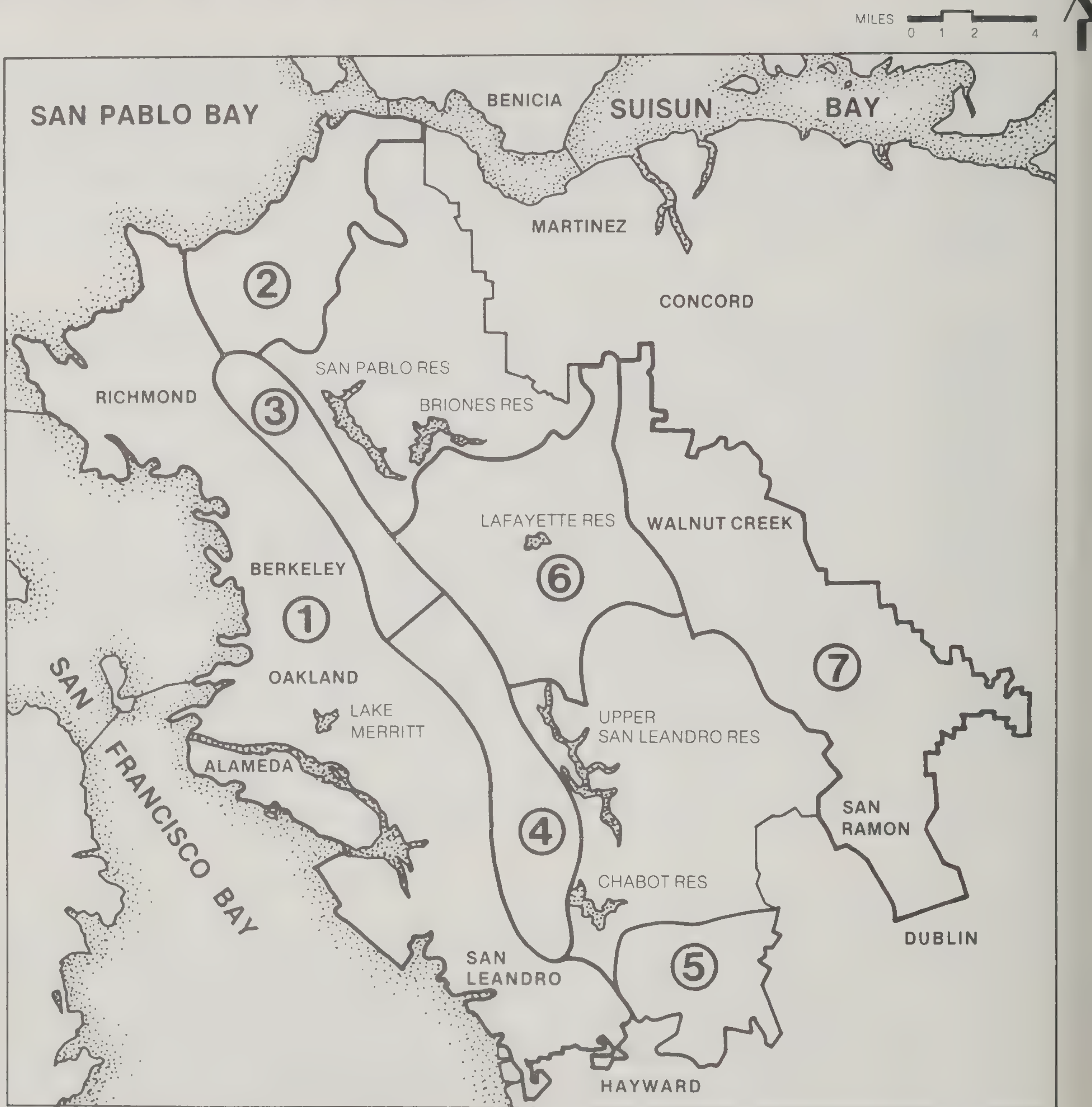
The growth that is expected to occur in the District's service area will produce considerable environmental change. The environmental changes cannot however be regarded as a direct consequence of the WSMP; they are a consequence of land planning decisions made by cities and counties. Some of the changes that are likely to occur are discussed below.

Land Use

Most of the new homes and commercial developments in the Cities of Berkeley, Oakland, Richmond, Alameda and Richmond will represent redevelopment of existing urban uses or

REGIONS OF THE DISTRIBUTION SYSTEM

FIGURE 10-1



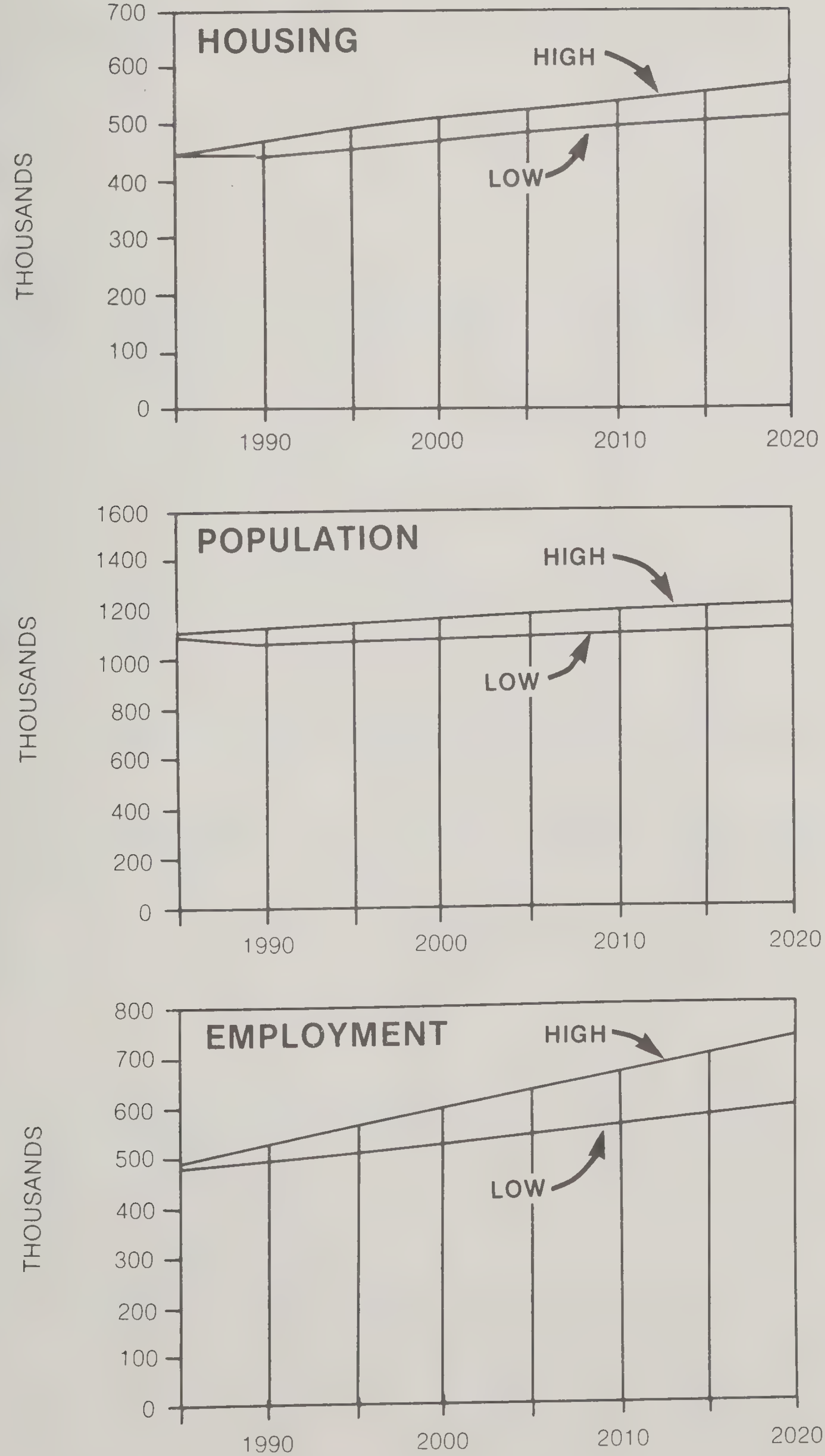
ALAMEDA COUNTY	REGION 1	2	3	4	5	6	7
Alameda	•						
Albany	•						
Berkeley	•		•				
Castro Valley					•		
Emeryville	•						
Hayward**	•				•		
Oakland	•		•	•			
Piedmont	•			•			
San Leandro	•			•			
San Lorenzo	•						

CONTRA COSTA COUNTY	REGION 1	2	3	4	5	6	7
Alameo-Backhawk							•
Danville							•
El Cerrito	•		•				
Hercules		•					
Lafayette						•	
Moraga						•	
Orinda						•	
Pinole		•					
Pleasant Hill**						•	•
Richmond	•	•	•				
Rodeo-Crockett		•					
San Pablo		•					
San Ramon							•
Walnut Creek**						•	•

** City not entirely served by EBMUD

HOUSING, POPULATION AND EMPLOYMENT PROJECTS

FIGURE 10-2



in-filling and densification of existing urban areas. Relatively small amounts of presently undeveloped land will be consumed by development. Development to the north, south and west of this core area will occur primarily on presently undeveloped land or on land used for agriculture. Conversion of open space to urban uses on the periphery of the area will increase the urban character of the Bay Area and make access to open space more difficult.

Traffic and Transportation

New homes and businesses will generate an increased demand for travel. Private vehicular trips and mass transit ridership can both be expected to increase. The most affected highways will be I-80, I-880, I-580, I-680 and Highway 24. Caltrans studies indicate that even allowing for planned improvements, peak-hour congestion on these highways will worsen and average speeds drop by the year 2000.

Conclusions regarding traffic conditions after the turn of the century are contingent upon fulfillment of ABAG Projections 85 with respect to jobs and housing. MTC has used these projections to generate estimated traffic volumes in the year 2000 and 2005. MTC predicts a 39% increase in workday vehicle miles of transit (VMT) for the Bay Area's nine counties, from a daily flow of 67,800,000 VMTs in 1980, to 94,189,000 in the year 2000.

Several corridor studies, conducted by MTC in order to analyze transportation investment options, provide greater detail about the EBMUD service area. These include the I-80, and I-680/I-580 corridor studies, which together cover a significant portion of the EBMUD service area. A description of conclusions relevant to the area serviced by EBMUD follows.

I-80 Corridor Study. Presently I-80 experiences severe congestion during commute periods, extending from Route 4 to the Bay Bridge. Numerous improvements to the I-80 transportation system will be completed before the year 2000, including construction of the I-580/Knox Freeway, expansion of Route 12 and San Pablo Avenue and construction of the I-80 Operational Improvement Project encompassing Route 4 to the Bay Bridge. Despite the enormous investments in highway improvements, I-80 is projected to experience severe peak-hour congestion in the year 2000 from Vallejo to the Bay Bridge. Commuters will seek alternative routes, thus impacting San Pablo Avenue and freeway frontage roads in the EBMUD service area.

I-680/I-580 Corridor Study. According to this study, in the year 2005, total vehicle trips in the I-680/I-580 corridor will increase by about 135,200, or 88% over those in 1980. North central Contra Costa County will continue to be the largest producer and attractor of transit trips.

The study also forecasts Level of Service (LOS) for select locations along the I-680/I-580 corridor during the AM peak-period commute. It predicts numerous segments in excess of capacity (LOS F), carrying variable, unstable and highly congested traffic flow. As peak-period travel demand exceeds capacity, the peak period will become longer. A number of areas will experience LOS E during peak-travel periods, which translates to unstable flow nearing capacity.

The most severely congested areas (LOS F) within the EBMUD service area are:

- o I-680 southbound from south of the Route 24 interchange to Crow Canyon Road.
- o Route 242 southbound between Route 4 and I-680.
- o The Caldecott Tunnel, westbound.

To provide some perspective, even with planned improvements, 50% of the intersections studied along south I-680 southbound will move from an AM peak-period condition of LOS A (free flowing) to o LOS F in 2005. Additionally, two out of five intersections studied on I-580 westbound (AM peak period) will reach capacity LOS E, while currently only at LOS A.

Segments predicted to be at level of service E, below the Caltrans acceptable standard, are:

- o I-680 southbound in the vicinity of Treat Boulevard, where the current design of the programmed widening calls for five lanes.
- o I-580 westbound immediately east of I-680.
- o I-680 southbound towards Fremont.
- o I-580 westbound through the Dublin Canyon.

While there are some inconsistencies in the study areas covered compared with the EBMUD service area, i.e. I-880 is not addressed, for practical purposes the traffic situations describe are relevant to the the area as a whole. These studies project traffic conditions only as far as 2005, yet it can reasonably be assumed that if these problems exist even with the proposed investments in highway and transit improvements, they are likely to exist or worsen further into the future.

AIR QUALITY

Population growth in the Bay Area, and the corresponding increases in traffic flows, is anticipated to increase air contaminant emissions and contribute to degradation of air quality. At the same time, regulatory agencies are developing policies and programs to control emissions, and the success of these measures will greatly influence future air quality. These regional air quality issues are being addressed by the Association of Bay Area Governments (ABAG), the Bay Area Air Quality Management District (BAAQMD) and the Metropolitan Transportation Commission (MTC).

Predicting future air quality conditions is a difficult task. This has recently been proven by the failure to achieve compliance with federal ambient air quality standards, despite implementation of control measures designed to reach attainment by 1987. These control measures were prescribed in the 1982 Air Quality Management Plan. The Bay Area is still in nonattainment of ambient air quality standards for ozone and carbon monoxide (CO). As the 1987 EPA deadline for compliance has come and gone, the ABAG, BAAQMD and MTC are now reviewing where efforts have failed and are developing new policies and control measures to achieve attainment in the future.

The 1987 Update of Air Quality Planning in the Bay Area, jointly published by ABAG, BAAQMD and MTC, discusses pertinent air quality issues and identifies new policies to guide planning efforts. The success of these efforts will largely influence future air quality.

According to the 1987 Update, the failure to attain ozone standards is largely due to the ineffectiveness of measures to control reactive organic gases (ROG) and nitrogen oxides (NO_x). As of August, 1987, the emissions reduction target for ROGs was 100 tons/day; that is, the additional reduction in reactive organic emissions necessary to attain the

ozone air quality standard is 100 tons/day. From 1980 to 1987, ROG emissions decreased by 290 tons/day. However, the problem is complicated by the inter-relationship of ROGs and NO_x in the formation of ozone. During that same seven-year period, NO_x emissions decreased by 1,000 tons/day. Thus, successful reductions in NO_x have served to impede the ozone reducing effects of the HC control measures, as implemented from the 1982 Plan.

The shortfall in meeting ROG reductions has been due to two factors: (1) the motor vehicle inspection/maintenance "Smog Check" program, implemented in 1984, has been less effective than anticipated (a 25% effectiveness will not be realized until about 1992), and (2) delay of five of the planned 23 stationary source control measures largely because of fiscal constraints.

The I/M program is the single most important measure available to reduce HC and CO emissions in the Bay Area. With implementation of a number of short- and long-term improvements to the I/M program, the 1987 Air Quality Planning Update identifies the following possible emission reduction estimates:

	HC	CO
Current Program	12.3%	9.8%
With Short-Term Improvements	26.9%	16.3%
With Long-Term Improvements	39.7%	25.2%

Transportation related control measures of the 1982 Plan, intended to reduce vehicle miles traveled (VMT) are considered to create minimal emissions reductions. In addition to the need to improve transportation systems in order to provide for better air quality, urban growth must be managed and directed effectively.

The California Air Resources Board has ventured some predictions regarding trends in emissions of specific criteria pollutants. Generally, CARB predicts:

SO_2 - emissions are essentially levelling out, with a slight increase between now and 2000;

Particulate Lead - the recent decline in emissions due to removal of lead from gasoline will continue;

PM_{10} - a 25% reduction in the Bay Area Air Basin by the year 2000;

CO - while some areas still exceed standards, recent decreases due to the motor vehicle control program will continue, dropping 24% by 2000;

NO_2 - currently a nonattainment pollutants, is anticipated to decrease 6% by 1995, then increase due to growth;

Ozone - also a nonattainment pollutant, for which the CARB has not been able to predict trends because of complicating factors described above;

ROGs - should decrease 16% by the year 2000, then increase, due to growth.

Thus, while it is hoped that implementation of control measures focussing on vehicle emissions will improve air quality, these efforts would be impeded by overall growth trends. Additionally, Bay Area air quality could be severely impacted by future development of oil and gas facilities in the Outer Continental Shelf. Exploration and production under Lease Sale 119, scheduled for November, 1990, could generate additional NO_x and HC emissions, the precursors to ozone formation. Other emissions include hydrogen sulfide, particulate matter, sulfur dioxide and CO. It is anticipated that OCS related emissions will thus lengthen the time frame necessary for attaining air quality standards.

11. ENVIRONMENTAL OVERVIEW

11.1 INTRODUCTION

The "State CEQA Guidelines" adopted by the State Resources Agency to implement the policies established by the passage of the California Environmental Quality Act of 1970 require that the various specific topics be discussed within all environmental impact reports. The CEQA-mandated impact overview requirements discussed in this section are the no-action alternative, significant adverse effects that cannot be avoided, cumulative impacts, the relationship between short-term uses of the environment and long-term productivity and irreversible environmental changes.

11.2 NO-ACTION ALTERNATIVE

A "no action" alternative would avoid the environmental effects of the proposed program discussed in the previous sections of this document. However, as expressed in Chapter 4 on alternative actions, if the District chose not to pursue the proposed Water Supply Management Plan and instead elected to do nothing, the result would be more frequent water shortages, greater risk of delivery system failure and possible adverse effects on public health and safety.

The "no action" alternative also precludes realization of any of the benefits associated with the proposed program.

11.3 SIGNIFICANT ADVERSE EFFECTS THAT CANNOT BE AVOIDED

The California Environmental Quality Act requires that significant adverse environmental effects that cannot be avoided be identified. Sections 15064 and 15065 of the State's guidelines for implementing the CEQA state that "A significant effect on the environment

is defined as a substantial or potentially substantial adverse change in the physical conditions which exist in the area affected by the proposed project including land, air, water, minerals, flora and fauna, ambient noise and objects of historic or aesthetic significance." Economic impacts alone are not considered to be significant effects on the environment unless they result in significant physical effects. While the guidelines provide some elaboration of what is meant by a "significant" impact, it obviously cannot be defined precisely. Ultimately, it remains up to the technical specialist of the particular resource to make some judgment on the matter.

In making the determination of significant impact, it was assumed that to be judged "significant and unavoidable" an adverse impact would have to involve a permanent or severe temporary degradation in the quality of the environment or the destruction of important natural and cultural resources that cannot be avoided by the incorporation of mitigation measures.

The only element of the WSMP that could produce significant adverse environmental effects are the terminal reservoirs. The loss of riparian vegetation and its associated wildlife due to inundation at Buckhorn and Pinole reservoirs is deemed significant because this habitat type is much reduced in California. Although the impact would be mitigated by the creation or enhancement of riparian zones elsewhere on EBMUD property, the loss of natural stands of riparian vegetation is still judged to be significant.

11.4 CUMULATIVE IMPACTS

The California Environment Quality Act (CEQA) requires consideration in an EIR of impacts which are individually limited but cumulatively considerable. "Cumulatively considerable" refers to incremental effects of an individual project which are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.

Construction of a new terminal reservoir would be but one of many water supply projects that affect the East Bay region. The cumulative effect of water resources development within the District's area of service is discussed in the Water Supply Management Plan Report. Because the proposed additional terminal reservoir storage project, once filled, would not increase the amount of water withdrawn from the source, the Mokelumne

River, the project would have no new cumulative effects beyond those already produced by the present level of water resources development.

The conversion of 900 to 1,200 acres of open space to a water supply reservoir at the Pinole or Buckhorn sites would contribute to the gradual conversion of land in the Bay Area from agriculture to urban uses. This would be offset by the purchase of acres of watershed land by EBMUD, because the intended land use -- water quality protection -- would prevent urban development.

The loss of natural riparian vegetation would contribute to the trend apparent in California for the last 100 years -- less than 2% of the wildlife habitat type remains. The proposed creation and enhancement of riparian areas elsewhere on EBMUD property would offset the loss due to inundation.

11.5 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Two elements of the WSMP, water conservation and reclamation, would contribute to long-term productivity of the environment by increasing the efficiency of water use. Two elements of WSMP would not affect long-term productivity. The terminal reservoirs trade-off long-term productivity of the environment at the reservoir sites with respect to wildlife habitat in favor of the short- to medium-term benefits of a more secure water supply for one to two million people.

11.6 IRREVERSIBLE ENVIRONMENTAL CHANGES

Construction of a terminal reservoir project would inundate lands that are not presently inundated. Buckhorn Dam would inundate 1,124 acres of valley rangeland while Pinole Dam would inundate 890 acres of somewhat broader valley range and farmland including present alignment of Pinole Valley Road. Los Vaqueros Dam would inundate from 3,000 to 5,000 acres of broad valley range and farmland in addition to a small section of Vasco Road.

This irreversible conversion of lands to water storage facilities would significantly alter the local environment at any candidate site. The extent and probable impact of such

change is considered greatest for the Los Vaqueros site as a broader range of present land use would be involved within the inundation area. The least impact of such irreversible change is associated with the Buckhorn site.

Development of any new terminal reservoir storage facility also represents an irreversible commitment of most of the building materials and all of the energy involved in their construction. Project implementation would require both an initial and continuing commitment of financial, human and natural resources. It is anticipated that neither construction nor operation of a terminal reservoir project would cause severe reductions in the availability of any particular natural resource (e.g., gravel, cement, asphalt, oil, etc.)

APPENDIX A

NOTICE OF PREPARATION

(Available for Review at EBMUD District Office)

APPENDIX B

EIR PREPARERS AND AGENCIES/INDIVIDUALS CONSULTED

EIR PREPARERS AND AGENCIES/INDIVIDUALS CONSULTED

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Hydrology	-	David Friedland
Geology and Soils	-	George Burwasser and Roger Papler
Vegetation and Wildlife	-	Ric Villasenor
Traffic	-	Rick Dowling
Noise	-	John Kennedy
Air Quality	-	David Friedland
Cultural Resources	-	Allan Pastron
Visual Quality	-	Jennifer Toth
Public Health and Safety	-	John Kennedy

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U.S. Fish and Wildlife Service	- Louise Accurso - Leigh Robinson

East Bay Regional Parks District	- Peter Alexander - Tom Lindenmeyer - Keven Shea
University of California, Museum of Vertebrate Zoology	- Dr. William Lidicker
California Office of Planning and Research	- Norma Wood
California State Hayward, Dept. of Biological Sciences	- Rolf W. Bensler
California Academy of Sciences	- W. Knight
Aleutian Canada Geese Recovery Team	- P. Springer
Mulberry Tree School	- Mary Ann McCloud
Joaquin Moraga Intermediate School	- Susan Harrison
Camino Pablo Elementary School	- Rita Fox
Moraga Public Library, Front Desk	
Saint Mary's College, Admissions Office	
U.S. Soil Conservation Service	- Bill Brunner
California Division of Mines and Geology	- Rob Hauser
U.S. Geological Survey	
Bay Area Air Quality Management District	- Milton Feldstein
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Administration	- Joanna Baker
Engineering Services and Design Division	- Olujimi Yoloye - Dennis Whiteneck
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Watershed Management	- Rod Tripp
U.S. Army Corps of Engineers	- Sharon Moorland

APPENDIX C

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APPENDIX D

DI - LIST OF PLANTS AND ANIMALS

DII - HISTORICAL OVERVIEWS

APPENDIX DI

LIST OF PLANTS AND ANIMALS

PLANT LIST

COMMON NAME	SCIENTIFIC NAME
Alder	Alnus rhombifolia
Arroyo Willow	Salix lasiolepis
Beard-Grass	Polypogon monspeliensis
Bedstraw	Galium sp.
Bellardia	Bellardia trixago
Big-Leaf Maple	Acer macrophyllum
Bird's-foot Trefoil	Lotus corniculatus
Bitter Cherry	Prunus emarginata
Black Medick	Medicago lupulina
Black Oak	Quercus kelloggii
Blackberry	Rubus sp.
Blow-Wives	Achyrachaena mollis
Blue Dicks	Dichlostemma puchellum
Blue Gum	Eucalyptus globulus
Blue-Eyed Grass	Sisyrinchium bellum
Bracken Fern	Pteridium aquilinum
Brittleleaf Manzanita	Arctostaphylos tomentosa ssp. crustacea
Bur Clover	Medicago polymorpha
Bur-Chervil	Anthriscus neglecta
California Bay	Umbellularia california
California Buckeye	Aesculus californica
California Canary-Grass	Phalaris californica
California Coffeeberry	Rhamnus californica
California Figwort	Scrophularia californica
California Fuchsia	Epilobium canum
California Gooseberry	Ribes californicum
California Hazelnut	Corylus cornuta ssp. californica
California Hop-Tree	Ptelea crenulata
California Pipevine	Aristolochia californica
California Polypody	Polypodium californicum
California Poppy	Eschscholzia californica
California Sage	Artemisia californica
California Tea	Psoralea physodes
Cat's Ear	Hypochaeris glabra
Cat-Tail	Typha latifolia
Cat-Tail	Typha sp.
Chamise	Adensostoma fasciculatum
Chase's Oak	Quercus X chasei
Checker	Sidalcea malvaeflora
Clover	Trifolium barbigerum
Clover	Trifolium tridentatum ssp. aciculare
Clover	Trifolium sp.
Coast Live Oak	Quercus agrifolia
Columbine	Aquilegia formosa
Common Barley	Hordeum vulgare
Cottonwood	Populus trichocarpa
Cow-Parsnip	Heracleum lanatum
Coyote Brush	Baccharis pilularis ssp. consanquinea
Coyote-Mint	Monardella sp.
Cream Bush	Holodiscus discolor
Cream Cups	Platystemon californicus
Current	Ribes divaricatum var. pubiflorum
Dense-flowered Lupine	Lupinus densiflorus ssp. aurea
Elderberry	Sambucus mexicana

PLANT LIST

Eriogonum	Eriogonum sp.
Evax	Evax sparsiflora
Fairy Bells	Disporum sp.
False Solomon's-Seal	Smilacina stellata var. sessilifolia
Fiddleneck	Amsinckia menziesii
Field Madder	Sherardia arvensis
Filaree	Erodium cicutarium
Four-spotted Godetia	Clarkia purpurea var. quadrivulnera
Foxtail	Hordeum sp.
Geranium	Geranium molle
Geranium	Geranium disectum
Gilia	Gilia achilleaefolia
Gold Backed Fern	Pityrograma triangularis
Gray Mule Ears	Wyethia helenioides
Hair-grass	Aira caryophyllea
Hedge-Nettle	Stachys ajugoides
Hedge-Nettle	Stachys rigida var. quercetorum
Hemp	Cannabis sativa
Hind's Walnut	Juglans hindsii
Hound's Tongue	Cynoglossum grande
Indian Paint-Brush	Castilleja foliolosa
Italian Thistle	Carduus pycnocephalia
Ithuriel's Spear	Triteleia laxa
Johnny Jump-up	Viola pedunculata
Lindley's Lupine	Lupinus bicolor
Little Quaking-Grass	Briza minor
Madrone	Arbutus menziesii
Meadow Barley	Hordeum brachyantherum
Meadow-Rue	Thalictrum polycarpum
Microseris	Microseris sp.
Milk Thistle	Silybum marianum
Miner's Lettuce	Claytonia perfoliata
Mint	Mentha sp.
Morning Glory	Convolvulus sp.
Mouse-ear Chickweed	Cerastium sp.
Mugwort	Artemisia douglasiana
Mustard	Brassica sp.
Narrow-Leaf Mule Ears	Wyethia angustifolia
Narrow-Leaf Plantain	Plantago lanceolata
Needle-Grass	Stipa sp.
Needle-Grass	Stipa pulchra
Neelde-Grass	Stipa sp.
Nemophila	Nemophila parviflorum
Nightshade	Solanum sp.
Nightshade	Solanum umbelliferum
Nut-Sedge	Cyperus sp.
Oso Berry	Osmaronia cerasiformis
Owl's Clover	Orthocarpus lithospermoides
Owl's Clover	Orthocarpus sp.
Pea	Lathyrus sp.
Peppergrass	Lepidium latipes
Peppergrass	Lepidium nitidium
Periwinkle	Vinca major
Phacelia	Phacelia sp.
Pineapple Weed	Matricaria matricoides

Pogogyne	Pogogyne serphylloides
Poison Hemlock	Conium maculatum
Popcorn Flower	Plagiobothrys trachycarpus
Popcorn Flower	Plagiobothrys nothofulvus
Prickly Ox-Tongue	Picris echioides
Rat-tail Fescue	Vulpia myuros
Red Brome	Bromus rubens
Red Maids	Calandrinia ciliata var. menziesii
Red Willow	Salix laevigata
Ripgut-Grass	Bromus diandrus
Rush	Juncus sp.
Sanicle	Sanicula bipinnatifida
Scarlet Pimpernel	Anagalis arvensis
Scouring Rush	Equisetum sp.
Sedge	Carex sp.
Service-Berry	Amelanchier alnifolia
Shepard's Needle	Scandix pecten-veneris
Shepard's Purse	Capsella bursa-pastoris
Smooth Brome	Bromus inermis
Snowberry	Symphoricarpus sp.
Soap-Plant	Chlorogalum pomeridianum
Soft Chess	Bromus mollis
Sorrel	Rumex acetosella
Spotted Medick	Medicago arabica
Steam Dogwood	Cornus stolonifera
Sticky Monkey-Flower	Mimulus aurantiacus
Stinging Nettle	Urtica holosericea
Strawberry	Fragaria sp.
Succulent Annual Lupine	Lupinus succulentus
Summer Lupine	Lupinus formosus
Sun Cups	Camissonia ovata
Sweet-Cicely	Osmorhiza chilensis
Thistle	Cirsium sp.
Tree Lupine	Lupinus albifrons
Trillium	Tirllium chloropetalum
Valley Oak	Quercus lobata
Verbena	Verbena sp.
Vetch	Vicia sativa
Vine Maple	Acer negundo
Wall Barley	Hordeum murinum
Water-Cress	Nasturtium officinale
White-Top	Cardaria draba
Wild Cucumber	Marah fabaceus
Wild Oats	Avena sp.
Wild Raddish	Raphanus sativus
Wood Rush	Luzula sp.
Woodland Star	Lithophragma sp.
Yarrow	Achillea millefolium
Yellow Sweet-Clover	Melilotus indica
Zigadene	Zigadenus sp.

PLANT LIST
KAISER/BUCKHORN CREEK SITE

GRASSLAND

HERBACEOUS DICOTS

Amsinckia intermedia
Amsinckia menziesii
Anagalus arvensis
Brassica sp.
Calandrinia ciliata menziesii
Camissonia ovata
Capsella bursa-pastoris
Cerastium sp.
Dichlostemma puchellum
Erodium cicutarium
Eschscholzia californica
Gilia achilleaefolia
Lepidium nitidum
Lupinus bicolor
Lupinus formosus
Matricaria matricoides
Medicago arabica
Medicago lupulina
Melilotus indica
Orthocarpus sp.
Plagiobothrys nothofulvus
Plantago lanceolata
Platystemon californicus
Ranunculus californica
Rumex acetosella ?
Sanicula bipinnatifida
Sherardia arvensis
Sidalcea malvaeflora
Sisyrinchium bellum
Raphanus sativus
Trifolium sp.
Triteleia laxa
Viola pedunculata
Wyethia helenioides

GRASSES

Avena sp.
Briza minor
Bromus diandrus
Bromus mollis
Bromus rubens
Hordeum murinum
Hordeum sp.
Lolium multiflorum
Stipa sp.
Vulpia myuros

TREES

Quercus lobata

SCRUB

DOMINANTS

Artemisia californica
Baccharis pilularis consanguinea
Lupinus albifrons
Mimulus aurantiacus
Rhamnus californica
Toxicodendron diversilobum

OTHERS

Artemisia douglasiana
Castilleja foliolosa
Chlorogalum pomeridianum
Epilobium canum
Eriogonum sp.
Marah fabaceus
Monardella sp.
Phacelia sp.
Pogogyne serphylloides
Potentilla glandulosa
Psoralea physodes
Pteridium aquilinum
Ribes californicum
Rubus sp.
Stipa pulchra
Vicia sp.
Wyethia helenioides
Zigadenus sp.

OAK WOODLAND & MIXED EVERGREEN FOREST

DOMINANTS

Acer macrophyllum
Aesculus californica
Arbutus menziesii
Quercus agrifolia
Umbellularia californica

UNDERSTORY

Anthriscus neglecta
Aquilegia formosa
Carex sp.
Claytonia perfoliata
Cynoglossum grande
Disporum sp.
Galium sp.
Geranium molle
Geranium disectum
Lathyrus sp.

Lithophragma sp.
Luzula sp.
Marah fabaceus
Nemophila parviflorum
Osmaronia cerasiformis
Osmorhiza chilensis
Pityrograma triangularis
Polypodium californicum
Psoralea physodes
Pteridium aquilinum
Quercus X chasei
Ribes californicum
Ribes divaricatum pubiflorum
Smilacina stellata sessilifolia
Stachys rigida quercetorum
Symphoricarpus sp.
Toxicodendron diversilobum
Trillium chloropetalum angustipetalum
Vicia sp.
Wyethia helenioides

RIPARIAN

Dominants

Acer macrophyllum
Acer negundo californicum
Alnus rhombifolia
Populus trichocarpa
Quercus agrifolia
Salix laevigata
Salix lasiolepis
Umbellularia californica

UNDERSTORY

Carex sp.
Claytonia perfoliata
Conium maculatum
Disporum sp.
Equisetum sp.
Fragaria sp.
Geranium molle
Heracleum lanatum
Juncus sp.
Juglans sp.
Marah fabaceus
Nasturtium officinale
Osmaronia cerasiformis
Psoralea physodes
Pteridium aquilinum
Ribes divaricatum
Rubus sp.
Sambucus sp.
Scrophularia californica
Smilacina stellata sessilifolia
Solanum umbelliferum
Solanum sp.

Stachys rigida quercetorum
Symphoriarpus sp.
Thalictrum polycarpum
Toxicodendron diversilobum
Trillium chloripetalum angustipetalum
Urtica holosericea

CHAPARRAL

Adenostoma fasciculatum
Amelanchier alnifolia
Arctostaphylos sp.
Castilleja foliolosa
Prunus emarginata
Quercus sp.
Zigadenus sp.

Pinole Creek Site

GRASSLAND

GRASSES

Aira caryophyllea
Avena sp.
Briza minor
Bromus diandrus
Bromus inermis
Bromus mollis
Bromus rubens
Hordeum brachyantherum
Hordeum murinum
Hordeum vulgare
Hordeum sp.
Lolium multiflorum
Phalaris californica
Stipa sp.
Vulpia myuros

TREES

Quercus lobata

HERBACEOUS DICOTS

Achillea millefolium
Achyrachaena mollis
Amsinckia intermedia
Anagalus arvensis
Aristolochia californica
Bellardia trixago
Brassica sp.
Capsella bursa-pastoris
Cardaria draba
Carduus phcnocephala
Carex sp.
Cerastium sp.
Clarkia purpurea quadrivulnera
Convolvulus sp.
Dichlostemma puchellum
Erodium cicutarium
Eschscholzia californica
Evax sparsiflora
Hypochaeris sp.
Lathyrus sp.
Lepidium latipes
Lepidium nitidum
Lotus corniculatus
Lupinus bicolor
Lupinus densiflorus aurea
Lupinus succulentus
Juncus sp.
Madia gracilis
Matricaria matricoides

Medicago lupulina
Medicago polymorpha
Melilotus indica
Microseris sp.
Orthocarpus lithospermoides
Plagiobothrys trachycarpus
Plantago lanceolata
Ranunculus californica
Rumex acetosella ?
Scandix pecten-vereris
Silybum marianum
Sisyrinchium bellum
Stachys ajugoides
Trifolium barbigerum
Trifolium tridentatum aciculare
Trifolium sp.
Triteleia laxa
Vicia sativa
Viola pedunculata
Whethia angustifolia
Wyethia helenioides

SCRUB

DOMINANTS

Artemisia californica
Baccharis pilularis consanguinea
Toxicodendron diversilobum

OTHERS

Artemisia douglasiana
Eriogonum sp.
Marah fabaceus
Potentilla glandulosa
Pteridium aquilinum
Rubus sp.
Stipa pulchra

OAK WOODLAND & MIXED EVERGREEN FOREST

DOMINANTS

Aesculus californica
Quercus agrifolia
Quercus kelloggii
Quercus lobata
Umbellularia californica

UNDERSTORY

Anthriscus neglecta
Carex sp.
Claytonia perfoliata

Corylus cornuta californica
Cynoglossum grande
Galium sp.
Geranium molle
Geranium disectum
Holodiscus discolor
Lathyrus sp.
Marah fabaceus
Nemophila parviflorum
Osmaronia cerasiformis
Osmorhiza chilensis
Pityrograma triangularis
Polypodium californicum
Potentilla glandulosa
Psoralea physodes
Ptelea crenulata
Pteridium aquilinum
Ribes californicum
Ribes divaricatum pubiflorum
Rubus sp.
Smilacina stellata sessilifolia
Stachys rigida quercetorum
Symphoricarpus albus
Toxicodendron diversilobum
Wyethia helenioides

RIPARIAN

Dominants

Aesculus californica
Cornus stolonifera (C. californica)
Eucalyptus globulus
Juglans hindsii
Quercus agrifolia
Salix laevigata
Salix lasiolepis
Umbellularia californica

UNDERSTORY

Bromus sp.
Carduus pycnocephala
Carex sp.
Claytonia perfoliata
Conium maculatum
Equisetum sp.
Fragaria sp.
Geranium molle
Heracleum lanatum
Juncus sp.
Marah fabaceus
Medicago sp.
Mentha sp.
Nasturtium officinale
Osmaronia cerasiformis
Psoralea physodes
Pteridium aquilinum

Ribes divaricatum
Rosa sp.
Rubus sp.
Sambucus mexicana
Solanum sp.
Symphoriarpus sp.
Toxicodendron diversilobum
Urtica holosericea

WILDLIFE LIST

APPENDIX
Buckhorn and High Pinole Reservoir Sites Species List
* = Observed on field surveys

MAMMALS

Common Name	Scientific Name	Habitat
Marsupial		
Opossum	Didelphis marsupialis	R,W
Insectivores		
Broad-footed mole	scaparus latimanus	G
Trowbridge shrew	Sorex trowbridgei	R,W
Ornate shrew	Sorex ornatus	R
Bats		
Volant myotis	Myotis volans	W
Yuma myotis	Myotis yumanensis	R,W
Big-eared myotis	Myotis evotis	W
California myotis	Myotis californicus	W
Big brown bat	Eptesicus fuscus	R,W
Pallid bat	Antrzous pallidus	W
Red bat	Lasiurus borealis	R
Western big-eared bat	Plecotus townsendii	W
Western pipistrelle	Pipistrellus hesperus	G
Lagomorphs		
Black-tailed hare*	Lepus californicus	G,S,C
Audubon cottontail*	Sylvilagus auduboni	W,S,C
Brush rabbit	Sylvilagus bachmani	S,C
Rodents		
California ground squirrel*	Citellus beecheyi	G
Western gray squirrel	Sciurus griseus	R,W
Botta pocket gopher*	Thomomys bottae	G
Western harvest mouse	Reithrodontomys megalotis	G,S,C
California mouse	Peromyscus californicus	W,S,C
Brush mouse	Peromyscus boylii	S,C
Pinyon mouse	Peromyscus truei	S,C
Deer mouse	Peromyscus maniculatus	R,W,G,S,C
Dusky-footed woodrat	Neotema fuscipes	R,W
California vole	Microtus californicus	G
Carnivores		
Red fox*	Vulpes fulva	G,S,C
Gray fox	Urocyon cinereoargenteus	G,S,C
Raccoon*	Procyon lotor	R,W
Ringtail	Bassariscus astutus	R
Long-tailed weasel	Mustela frenata	G,W,S,C
Striped skunk	Mephitis mephitis	R,G
Mountain lion	Felis concolor	W,G,S,C
Bobcat	Lynx rufus	R,W,G,S,C
Coyote	Canis latrans	R,W,G,S,C
Hoofed Animals		
Black-tailed deer*	Odocoileus hemionus	W,R,G,S,C

BIRDS

Common Name	Scientific Name	Habitat
Common loon	*Gavia immer*	A
Pied-billed grebe	*Podilymbus podiceps*	A
Western grebe	*Aechmophorus occidentalis*	A
Great egret*	*Casmerodius albus*	A
Snowy egret	*Egretta thula*	A
Great blue heron*	*Ardea herodius*	A
Green-backed heron	*Butorides striatus*	A,R
Snow goose	*Chen c. caerulescens*	A
Ross' goose	*Chen rossii*	A
Canada goose	*Branta canadensis*	A
Aleutian Canada goose	*Branta canadensis leucopareia*	A
White-fronted goose	*Anser albifrons*	A
Mallard*	*Anas platyrhynchos*	A
Wood duck	*Aix sponsa*	A,R
Common merganser	*Mergus merganser*	A
Turkey vulture*	*Cathartes aura*	R,G,W,S,C
Black-shouldered kite	*Elanus caeruleus*	R,G
Sharp-shinned hawk	*Accipiter striatus*	R,W
Cooper's hawk	*Accipiter cooperii*	R,W,S,C
Swainson's hawk	*Buteo swainsoni*	R,G
Red-tailed hawk*	*Buteo jamaicensis*	R,G,W
Northern Harrier	*Circus cyaneus*	R,G
Golden eagle*	*Aguila chrsaetos*	R,G,W
Osprey	*Pandion haliaetus*	A,R
American kestral	*Falco sparverius*	G,W,S,C
California quail*	*Lophortyx californicus*	G,W,S,C
American coot	*Fulica americana*	A
Killdeer*	*Charadrius vociferus*	G
Band-tailed pigeon	*Columba fasciata*	R,W
Rock dove*	*Columbau livia*	G,W
Mourning dove*	*Zenaida macroura*	R,W,S,C
Barn owl	*Tyto alba*	G,R,W
Screech owl	*Otus asio*	W
Great horned owl	*Bubo virgianus*	R,W
Anna's hummingbird	*Calypte anna*	R,W,S,C
Rufous hummingbird	*Salasphorus rufus*	R,W,S,C
Allen's hummingbird	*Salasphorus sasin*	R,W,S,C
Calliope hummingbird	*Stellula calliope*	R
Belted kingfisher	*Megaceryle alcyon*	A,R

Common Name	Scientific Name	Habitat
Northern flicker*	Colaptes auratus	R,W
Yellow-bellied sapsucker*	Sphyrapicus varius	R,W
Hairy woodpecker	Picoides villosus	R,W
Downy woodpecker	Picoides pubescens	R,W
Nuttall's woodpecker	Picoides nuttallii	R,W
Acorn woodpecker	Melanerpes formicivorus	R,W
Ashthroated flycatcher*	Myiarchus cinerascens	R,W
Black phoebe	Sayornis nigricans	R,W
Say's phoebe	Sayornis saya	G,R,W,S,C
Western flycatcher*	Empidonax difficilis	R,W
Olive-sided flycatcher	Nuttallornis borealis	R
Western kingbird	Tyrannus verticalis	G,R,W
Violet-green swallow	Tachycineta thalassina	G,W
Rough-winged swallow	Stelgidopteryx ruficollis	G,W
Barn swallow*	Hirundo rustica	G,W
Bank swallow	Riparia riparia	A,R
Cliff swallow	Petrochelidon pyrrhonota	A,G,W,R
Tree swallow	Iridoprocne bicolor	R,W
Steller's jay*	Cyanocitta stelleri	R,W,S,C
Scrub jay*	Aphelocoma coerulescens	R,W,S,C
Common crow*	Corvus brachyrhynchos	R,W,S,C
Chestnut-backed chickadee*	Parus rufescens	R
Plain titmouse*	Parus inornatus	R,W
Bushtit*	Psaltiparus minimus	R,S,C
Red-breasted nuthatch	Sitta canadensis	R
White-breasted nuthatch	Sitta carolinensis	R
Brown creeper	Certhia familiaris	R
Wrentit	Chamaea fasciata	S,C
Dipper	Cinclus mexicanus	R
Winter wren	Troglodytes troglodytes	R
Bewick's wren*	Thryomanes bewickii	S,C
Mockingbird*	Mimus polyglottos	R,W,S,C
California thrasher	Toxostoma redivivum	S,C
American robin	Turdus migratorius	R,W,S,C
Varied thrush	Ixoreus naevius	W
Hermit thrush	Catharus guttatus	R,S,C
Swainson's thrush	Catharus ustulatus	R
Western bluebird*	Sialia mexicana	W,S,C
Golden-crowned kinglet	Regulus satrapa	W,R
Ruby-crowned kinglet	Regulus calendula	W,R
Starling*	Sturnus vulgaris	G,R

Common Name	Scientific Name	Habitat
Solitary vireo	Vireo solitarius	R,W
Warbling vireo	Vireo gilvus	R,W
Yellow warbler*	Dendroica petechia	R,W
Yellow-rumped warbler	Dendroica coronata	R,W
Townsend's warbler	Dendroica townsendi	R,W
Wilson's warbler	Wilsonia pusilla	R,W,S,C
House sparrow	Passer domesticus	G,S,C
Western meadowlark*	Sturnella neglecta	G
Red-winged blackbird*	Aagelaius phoeniceus	G,R
Brewer's blackbird	Euphagus cyanocephalus	G,R
Bullock's oriole	Icterus galbula bullockii	R,W
Dark-eyed junco*	Junco hyemalis	R,W
Purple finch*	Carpodacus purpureus	R,W
House finch*	Carpodacus mexicanus	G,R,W
American goldfinch*	Carduelis tristis	G,R
Lesser goldfinch*	Carduelis psaltria	R,W,S,C
Rufous-sided towhee*	Pipilo erythrophthalmus	R,S,C
Brown towhee*	Pipilo fuscus	R,S,C
Savannah sparrow	Passerculus sandwichensis	G
White-crowned sparrow	Zonotrichia leucophrys	S,C
Golden-crowned sparrow	Zonotrichia atricapilla	S,C
Fox sparrow	Passerella iliaca	S,C
Lincoln's sparrow	Melospiza lincolnii	R,W
Song sparrow	Melospiza melodia	G,R,S,C

AMPHIBIANS

Rough-skinned newt	Taricha granulose	A,R,W
California newt*	Taricha toriosa	A,R,W
Arboreal salamander	Aneides lugubris	R,W
California slender salamander	Batrachoseps attenuatus	R,W
Ensatina	Ensatina eschscholtzii	R,W
Red-legged frog	Rana aurora	A,R
Bullfrog*	Rana catesbeiana	A,R
Pacific treefrog	Hyla regilla	A,R

REPTILES

Common Name	Scientific Name	Habitat
Western pond turtle*	*Clemmys marmorata*	A,R
Western fence lizard*	*Sceloperus occidentalis*	R,W,S,C
Northern alligator lizard*	*Gerrhonotus coeruleus*	G,R,W,S,C
Southern alligator lizard	*Gerrhonotus multicarinatus*	G,R,W.S,C
Western skink	*Eumeces skiltonianus*	W,R,S,C
Ringneck snake	*Diadophis punctatus*	R
Common kingsnake	*Lampropeltis getulus*	G,S,C
Alameda striped racer	*Masticophis lateralis euryxanthus*	R,S,C
Gopher snake	*Pituophis melanoleucus*	G,S,C
Western aquatic garter snake	*Thamnophis couchi*	A,R
Western terrestrial garter snake	*Thamnophis elegans*	A,R
Common garter snake	*Thamnophis sirtalis*	A,R

KEY

A - Aquatic
G - Grassland
R - Riparian
S - Scrub
C - Chaparral
W - Woodland

1985 UPPER SAN LEANDRO RESERVOIR—AREA P
CHRISTMAS BIRD COUNT

DOUBLE-CRESTED CORMORANT	3
GREAT BLUE HERON	2
CANADA GOOSE	378
MALLARD	25
RING-NECKED DUCK	9
RUDDY DUCK	8
TURKEY VULTURE	3
COOPER'S HAWK	1
ACCIPITER SPECIES	1
RED-TAILED HAWK	2
AMERICAN KESTREL	6
CALIFORNIA QUAIL	2
AMERICAN COOT	53
GULL SPECIES	30
MOURNING DOVE	3
NUTTALL'S WOODPECKER	4
DOWNY WOODPECKER	1
NORTHERN FLICKER	12
BLACK PHOEBE	5
SAY'S PHOEBE	2
STELLER'S JAY	9
SCRUB JAY	11
CHESTNUT-BACKED CHICKADEE	26
BUSHTIT	34
BEWICK'S WREN	2
RUBY-CROWNED KINGLET	61
WESTERN BLUEBIRD	19
HERMIT THRUSH	1
AMERICAN ROBIN	53
VARIED THRUSH	17
WRENTIT	4
CALIFORNIA THRASHER	1
YELLOW-RUMPED WARBLER	3
RUFOUS-SIDED TOWHEE	6
BROWN TOWHEE	4
LARK SPARROW	14
FOX SPARROW	4
SONG SPARROW	1
GOLDEN-CROWNED SPARROW	13
WHITE-CROWNED SPARROW	21
DARK-EYED JUNCO OREGON	25
HOUSE FINCH	13
LESSER GOLDFINCH	2

SOURCE: Golden Gate Aububon Society

1985 UPPER SAN LEANDRO RESERVOIR—AREA P

PIED-BILLED GREBE	2
DOUBLE-CRESTED CORMORANT	3
GREAT BLUE HERON	2
GREATER WHITE-FRONTED GOOSE	25
CANADA GOOSE	575
WOOD DUCK	15
MALLARD	35
RUDDY DUCK	14
HOODED MERGANSER	2
TURKEY VULTURE	6
SHARP-SHINNED HAWK	2
ACCIPITER SPECIES	1
RED-TAILED HAWK	4
AMERICAN KESTREL	2
CALIFORNIA QUAIL	26
AMERICAN COOT	38
KILLDEER	8
GREATER YELLOWLEGS	2
SPOTTED SANDPIPER	4
LONG-BILLED DOWITCHER	117
GULL SPECIES	4
BAND-TAILED PIGEON	2
ROCK DOVE	3
MOURNING DOVE	22
WESTERN SCREECH-OWL	2
GREAT HORNED OWL	2
ANNA'S HUMMINGBIRD	2
BELTED KINGFISHER	1
RED-BREASTED SAPSUCKER	3
NUTTALL'S WOODPECKER	4
DOWNY WOODPECKER	2
NORTHERN FLICKER	22
BLACK PHOEBE	5
STELLER'S JAY	5
SCRUB JAY	18
CHESTNUT-BACKED CHICKADEE	17
PLAIN TITMOUSE	20
BUSHTIT	57
BROWN CREEPER	2
BEWICK'S WREN	9
RUBY-CROWNED KINGLET	21
WESTERN BLUEBIRD	35
HERMIT THRUSH	18
AMERICAN ROBIN	375
VARIED THRUSH	7
WRENTIT	20
CALIFORNIA THRASHER	3
CEDAR WAXWING	138
LOGGERHEAD SHRIKE	2
EUROPEAN STARLING	9
HUTTON'S VIREO	8
YELLOW-RUMPED WARBLER	4
AUDUBON'S WARBLER	1
TOWNSEND'S WARBLER	7
HERMIT WARBLER	1
RUFOUS-SIDED TOWHEE	14
BROWN TOWHEE	34
FOX SPARROW	4
SONG SPARROW	5
GOLDEN-CROWNED SPARROW	19
WHITE-CROWNED SPARROW	66
DARK-EYED JUNCO OREGON	63
WESTERN MEADOWLARK	2
PURPLE FINCH	7
HOUSE FINCH	145
PINE SISKIN	1
AMERICAN GOLDFINCH	2
LESSER GOLDFINCH	4

SOURCE: Golden Gate Aububon Society

*1986 UPPER SAN LEANDRO RESERVOIR - AREA = P

Great Blue Heron	1
Canada Goose	235
(Canada) Goose	1
Wood Duck	10
Mallard	165
Canvasback	3
Ring-necked Duck	33
Com. Merganser	1
Ruddy Duck	9
Turkey Vulture	5
Sharp-shinned Hawk	1
Red-tailed Hawk	2
Golden Eagle	1
Am. Kestrel	5
California Quail	10
Am. Coot	40
Greater Yellowlegs	1
Spotted Sandpiper	1
California Gull	5
Rock Dove	35
Mourning Dove	2
Great Horned Owl	2
Anna's Hummingbird	10
Acorn Woodpecker	4
Nuttall's Woodpecker	6
Downy Woodpecker	3
N. Flicker	25
Black Phoebe	7
Say's Phoebe	3
Steller's Jay	26
Scrub Jay	38
Am. Crow	1
Com. Raven	1
Chestnut-backed Chickadee	46
Plain Titmouse	6
Bushtit	44
White-breasted Nuthatch	1
Brown Creeper	1
Bewick's Wren	8
Golden-crowned Kinglet	1
Ruby-crowned Kinglet	24
W. Bluebird	41
Hermit Thrush	14
Am. Robin	59
Varied Thrush	11
Wrentit	36
N. Mockingbird	2
California Thrasher	2
Water Pipit	71
Cedar Waxwing	30
Eur. Starling	19
Hutton's Vireo	5
Yellow-rumped Warbler	18
Townsend's Warbler	3
Rufous-sided Towhee	16
Brown Towhee	22
Fox Sparrow	3
Song Sparrow	1
Golden-crowned Sparrow	48
White-crowned Sparrow	8
Dark-eyed Junco	95
W. Meadowlark	6
House Finch	61
Lesser Goldfinch	7
Am. Goldfinch	12

SOURCE: Golden Gate Aububon Society

APPENDIX DII

HISTORICAL OVERVIEW

Historical Overview of the Proposed Buckhorn Reservoir Site
Alameda and Contra Costa Counties, California

Submitted to:

EIP Associates
319 Eleventh Street
San Francisco, California 94103

Submitted by:

Archeo-Tec
114 Wilding Lane
Oakland, California 94618
24 August, 1987

Site Location and Description

At the request of Mr. John Davis of EIP Associates in San Francisco, Allen G. Pastron, Ph.D, of Archeo-Tec has conducted an archival survey of the history of the proposed Buckhorn Reservoir site in Alameda and Contra Costa counties, California. The principal goals of the present report are to provide a general overview of the history of the project site and to describe the uses to which the property has been put from prehistoric times through the twentieth century. In order to develop the proposed Buckhorn Reservoir, the project sponsor, the East Bay Municipal Utility District (EBMUD), proposes to construct a dam and associated facilities and inundate an area of approximately 1601 acres.

The subject property is basically characterized by gently rolling grasslands, ranging in elevation between 460 and 840 feet above mean sea level. Dominant vegetation consists primarily of introduced, low-lying grasses including bunch grasses, brome grass, needle grass and a variety of forbs including cobweb thistle, cardoon thistle, lupine, Brodiaea, California Poppy, wild radish and mustard. Stands of Coast live oak and buckeye occur locally.

Riparian and sub-riparian conditions occur along permanent and semi-permanent drainages. The principal drainages within the project area are Buckhorn Creek, which courses in a southerly

direction, and Kaiser Creek, which courses southwesterly. Both of these drainages are lined, indeed choked, with riparian vegetation in the form of Coast live oak, Alder, California bay laurel, willow, maple, buckeye, sweet fennel, dock, berry thickets and poison oak; localized stands of bull rush, other rushes, cattails, and sedges were noted, especially near the center of the project area where the canyons open up and Buckhorn and Kaiser creeks come together. Finally, stands of imported eucalyptus were observed scattered throughout the proposed Buckhorn Reservoir site.

Dominant site geology consists primarily of soft, weathered sandstone which outcrops only rarely throughout the project area. Light brown, sandy soils predominate throughout the subject property. These soils are overlain by a layer of dark brown sandy topsoil of approximately 15 centimeters in depth throughout much of the project site. Numerous solifluction slumps resulting from meandering springs were observed throughout much of the proposed Buckhorn Reservoir project area.

Present usage of the proposed Buckhorn Reservoir is primarily devoted to cattle grazing. Alteration to the natural landscape has been extremely minimal: a series of dirt roads crisscross the project area. In addition, a single barn with attendant corrals was observed. Other sources of topographic disturbance include power lines, cattle trails and wallows.

The Prehistoric Period (Ca. 6000 B.C. - 1770 A.D.)

The first task of the present historical survey was to determine the potential for encountering archaeological resources from the prehistoric period within the confines of the subject parcel. When the Spanish first explored northern California in the latter part of the eighteenth century, the region possessed what has been described as "the densest Indian population anywhere north of Mexico" (Margolin 1978:1). It has been estimated that between 7,000 and 10,000 native Californians inhabited the naturally fruitful coastal area between Point Sur in Monterey County and the San Francisco Bay (Kroeber 1925:464).

Much of this aboriginal population must have been situated along the eastern shoreline of the San Francisco Bay; for by all accounts, the region, in its natural state, was one of the richest, most bountiful natural environments in California. Before the onset of large scale Anglo-American immigration and development in the second half of the nineteenth century, the present subject area and its surroundings consisted of a largely level grassy plain; impressive stands of oak trees were scattered throughout the area. From the shoreline of the Bay, the ground rose sharply toward the east. In the hills above the future towns of Oakland, Berkeley and San Leandro, there existed a magnificent stand of redwoods: some of these trees are said to have exceeded thirty feet in diameter and three hundred feet in

height (Gibbons 1893; Burgess 1951). These redwoods were so prominent and conspicuous that Gold Rush era sea captains used the tallest trees as navigational landmarks upon entering the Golden Gate some sixteen miles to the west (Bagwell 1982:15). The region was watered by several large creeks that flowed from the hills into the Bay. In the spring, the fertile ground was covered as far as the eye could see by California poppies and other wild flowers (ibid:3). Deer, rabbits, wildcats, raccoons, grizzly bears and numerous small animals abounded throughout the area. Wildfowl flourished around the various streams and marshes scattered throughout the region.

Native American shellmounds -- massive heaps of ash, shell and cultural refuse -- once dotted the shoreline and adjacent inland areas of the San Francisco Bay. When N.C. Nelson conducted the first intensive archaeological of the region in 1908, he recorded no less than four hundred and twenty-five aboriginal shellmounds on or near the shoreline of the bay (Nelson 1909). Numerous other archaeological sites, containing the material remnants left by the region's numerous Native American inhabitants were located in the hills to the east of the Bay's original shoreline.

With this introduction to the prehistory of the San Francisco Bay area, we now turn to the evidence at hand for the proposed Buckhorn Reservoir site.

The project area is situated in the territory which, at the beginning of the historic period, was occupied by the Costanoan Indians (see Key to Tribal Territories Map" in Heizer 1978: ix). The populous Costanoans inhabited a bountiful natural environment and, as we have seen, left behind a prolific archaeological record. With this in mind, A.L. Kroeber noted the following:

> The entire Costanoan frontage on ocean and bay is lined with shell deposits. San Francisco Bay in particular is richer in such remains than any other part of the state, except perhaps the Santa Berbara Islands (1925:466).

Ethnographic and archaeological summaries of the Costanoans can be found in the following sources: The Handbook of North American Indians, volume 8 (see Levy 1978:485-495), the Handbook of California Indians (Kroeber 1925:462-473, California Archaeology (Moratto 1984), The Archaeology of California (Chartkoff and Chartkoff 1984) and The Ohlone Way: Indian Life in the San Francisco - Monterey Bay Area (Margolin 1978).

Archival research revealed that no archaeological sites of either prehistoric or historic period age or character have been recorded within the confines of the proposed Buckhorn Reservoir site: nor had any archaeological sites been recorded within a one mile radius of the 1601 acre subject property.

Between May and July, 1987, the staff of Archeo-Tec, under the supervision of the present writer, conducted an intensive

archaeological surface reconnaissance of the proposed Buckhorn Reservoir site. The results of this research are contained in two reports prepared by the present writer entitled A Literature Search and Archaeological Surface Reconnaissance of the Proposed High Buckhorn Reservoir, Alameda and Contra Costa Counties, California, and A Supplementary Literature Search and Archaeological Surface Reconnaissance of the Proposed Buckhorn Reservoir, Alameda and Contra Costa Counties, California (Archeo-Tec 1987a; 1987b).

The on-site surface reconnaissance of the proposed High Buckhorn Reservoir Project encountered two distinct archaeological sites within the subject property -- one of historic period age and characteristics, and another adjacent site of prehistoric and/or proto-historic affinities. These two archaeological sites have been respectively designated CA-Ala-481 and CA-Ala482H, respectively. Site records and other information pertaining to these archaeological sites are now on file at the Northwest Information Center at Sonoma State University in Rohnert Park, California.

CA-Ala-481 is located along Kaiser Creek and Kaiser Creek Road. As observable from archaeological surface manifestations, the site is characterized by four bedrock mortar features, consisting of two sandstone boulders, each with a single cup, situated on the west side of Kaiser Creek, and two other sand-

stone boulders respectively featuring two mortar cups and a grinding slick within the Kaiser Creek channel. In addition to the four bedrock mortar features, one definite pecked rock art element was recorded on a sandstone boulder on the east side of Kaiser Creek, as well as several possible grooved elements on the west side.

CA-Ala-482H is an historic period archaeological site consisting of a single-course stone foundation fabricated of locally available sandstone forming a rectangle with a south facing entrance. Two adjacent depressions may represent the remnants of out-buildings and/or trash pits. A variety of historic period artifacts were observed in close proximity to these architectural features, including a metal stove part, several rusted metal pipes, white "ironstone" ceramic fragments, and numerous shattered glass bottles. One glass bottle base was embossed with a registration date of 1882 (Godden 1964).

As noted above, archaeological sites CA-Ala-481 and CA-Ala-482H were found in close physical proximity to one another, and the possibility that these two sites may be either temporally and/or functionally associated in some way could not be ruled out on the basis of the evidence acquired from surface archaeological reconnaissance.

The Historic Period (1770 - Present)

The East side of the San Francisco Bay was first explored by the Portola expedition in 1769-70; a few years later, in 1772, Pedro Fages made a more thorough survey of the region (Conmy 1961:3). Between the appearance of the first Spanish ship to sail through the Golden Gate (the San Carlos under the command of Lieutenant Juan Bautista de Ayala), and the discovery of gold at Sutter's Mill, the East Bay region remained almost entirely undeveloped and uninhabited by Europeans. During this period, population and maritime traffic were extremely limited throughout the San Francisco Bay area. The Presidio at San Francisco was officially founded on the site near the Golden Gate in September, 1776, in a place convenient for the emplacement of an artillery battery at the narrowest part of the harbor entrance. A month later, the Mission was founded at the Laguna de los Dolores (Olmsted, Olmsted and Pastron 1977:257). Throughout the remainder of the eighteenth century, the eastern shore of the bay was occupied solely by its Native American inhabitants.

Luis Maria Peralta was the first individual of European ancestry to be associated with the East Bay region. Born in Tubac, Sonora, Mexico, Don Luis Peralta came to California with his parents as part of the Anza expedition in 1775. About six years later, he enlisted in the military service at the Presidio of Monterey; for most of his career, however, he served and resided at the Presidio at San Francisco. In 1820, Don Luis Peralta retired from the military, and as a reward for years of

faithful, dedicated service to the King of Spain, Don Pablo Vicente de Sola, the Governor of Alta California, granted him a tract of land of eleven leagues (44,800 acres) extending from San Leandro Creek on the southeast to El Cerrito Creek on the northwest.

Don Luis Maria Peralta named his vast holdings Rancho San Antonio (Halley 1876:39). All of the present-day communities of Oakland, Berkeley, Piedmont, Albany, Emeryville, Alameda as well as the northern part of San Leandro were contained within Don Luis Peralta's land grant. Hence, the southeastern corner of the vast Rancho San Antonio encompassed the Alameda County portion of the present Buckhorn Reservoir site.

Don Luis Peralta never made his home within the vast Rancho San Antonio, and for more than twenty years the land remained unoccupied, except for the activities of his sons, a few vaqueros and a small number of Indian workers (Conmy 1961:4).

Don Luis Peralta and his wife Maria had seventeen children, nine of whom survived into adulthood (Bagwell 1982:11). Before he died in 1851 at the age of 93, Don Luis Peralta divided the Rancho San Antonio between his four sons (Thompson and West 1878:19). Rancho San Antonio was parceled out in the following manner:

The lands commencing at the southeastern boundary of

> San Leandro Creek were given to Ignacio [whose] estate extended to approximately where Seminary Avenue now is. Ignacio Peralta, baptized Hermenegildo Ignacio, was born April 13, 1791 and died May 9, 1874 at the age of 85 years.
>
> To Antonio Maria Peralta, his father gave the lands which generally comprise the area from the present Seminary Avenue line to Lake Merritt. He built his home in the foothills overlooking the present Fruitvale district. He was born on August 16, 1801 and died on February 22, 1879, at the age of 78.
>
> Vicente Peralta, baptized Jose Vicente, was given the area running from the southern end of Lake Merritt down to the bay on the west, and thence following the bay shore beyond the present Temescal district. All of the original [town of] Oakland was within Vicente Peralta's estate. He was born on November 21, 1812 and died on June 30, 1871, at the age of 59.
>
> The fourth son, Jose Domingo, was given the northwestern area, including the present cities of Berkeley and Albany and also in its southern extremity a small portion of the present city of Oakland. Jose Domingo Peralta was born December 3, 1795 and died on April 3, 1865 at the age of 70 years (Conmy 1961:4).

As we have seen, that part of the Buckhorn Reservoir site situated within Alameda County fell within the lands granted by Don Luis Peralta to his son Ignacio. The Contra Costa County portion of the subject parcel was located on the periphery of <u>El Rancho de la Laguna de los Palos Colorados</u>, granted to Joaquin Moraga by the Mexican authorities in 1841.

Each of the four Peralta sons settled upon his respective portion of Rancho San Antonio. Like his brothers, Ignacio Peralta built an adobe and settled his vast holdings. Ignacio Peralta's original house was located within the present city of San Leandro, well to the west of the Buckhorn Reservoir project

site. Jacob Bowman describes the manner of life on the early California ranchos:

> On the ranchos of the bay counties the number and locations of the adobes varied. At most ranchos there was only one adobe at the homestead, but on others one or more buildings were erected within a few feet or at some distance from the first dwelling. As the sons and daughters of the owners married, they built their adobes nearby or on more distant parts of the ranchos. Between 1820 and 1842 adobes were erected by the Bernal family on Rancho Santa Rita, the Higueras on Rancho Milpitas, the Younts on Rancho Caymus, the Martinez children on Rancho Pinole, and the Peralta sons on Rancho San Antonio (1951:59).

Like almost all of the landed Spanish families in Alta California, the Peraltas made their living from agriculture and animal husbandry (De Veer 1924:34-35). The four Peralta brothers grew a variety of crops and raised cattle on their respective portions of Rancho San Antonio. There was also a considerable amount of logging, especially in the stands of redwoods which dominated the hills overlooking the future city of Oakland (Conmy 1961:6). However, the great economic and social development of the East Bay region would await the coming of the Americans who, within a relatively brief span of time, would change the face of the area forever.

Historical research revealed that Ignacio Peralta never inhabited or developed the parcel of land under consideration in this report. As we have seen, his house was situated well to the west of the present Buckhorn Reservoir project area. Indeed, there is no record of any adobes ever existing on the property during the early historic period (Hendry and Bowman 1940:586)

Further, there is no evidence whatever that any of the activities of the Peralta family, or those of the Moragas in Contra Costa County, resulted in any significant impact upon the present subject property. This finding is not surprising considering the relatively scarce and scattered population in the East Bay region throughout the period of Spanish/Mexican hegemony over the region. Jacob Bowman notes that a total number of 115 adobes were built within the confines of present day Alameda County during this period, and an additional 57 structures were erected in what today is Contra Costa County (1851:59).

The town of San Francisco -- or Yerba Buena as it was then called -- was founded in 1835 when an Englishman named W.A. Richardson pitched a tent near present day Portsmouth Square (Watkins and Olmsted 1976:14). For the next decade and a half, the little town of Yerba Buena grew steadily, if unspectacularly. During this time, Rancho San Antonio remained exclusively in the hands of the Peralta family. It was not until the Gold Rush era that American settlers in Northern California first cast their eyes upon the fertile but undeveloped lands on the east side of the San Francisco Bay.

Beginning in 1849, an increasing number of Anglo-Americans found their way onto the Peralta estate. As early as 1846, William Heath Davis, one of San Francisco's prominent early citizens, recorded the following observation:

> In my travels around the bay on business, I had observed a picturesque spot for a town on the estuary of San Antonio, due east from San Francisco. The site was known in early times as Encinal de Temescal, on Vicente Peralta's portion of the division of the Ranch San Antonio, segregated by Don Luis Peralta, his father. The site is the present city of Oakland (Davis 1889:251).

Davis was one of the first of many Americans to recognize the commercial potential of Vicente Peralta's property, and he claims to have made an attempt to purchase a portion of the Rancho San Antonio:

> My relation with Don Vicente was good, socially and commercially. In the fall of 1846 he was in my store making purchases. I told him I had a proposition to make for his consideration, and I desired for him to dine with me that evening. After dinner, I broached the matter by saying to him, "you are the owner of the Encinal de Temescal and there is a spot on that part of your rancho that please me for a town." He wanted to know the exact location of the place, and I pointed it out to him on a rough map I had prepared for the purpose. I offered him $ 5,000 cash for two-thirds of the Encinal, to build a church of his faith, also to construct a wharf and run a ferryboat from San Francisco to the intended town, all of which to be at my cost and expense. Whenever sales of lots were made, we would both sign the deeds and each take his pro rata of the money. Don Vicente, in reply to my talk, said that he would take the matter under advisement and let me know (ibid).

Hoping to keep his part of the Rancho San Antonio intact, Don Vicente Peralta decided to decline Davis' offer. However, the tide of American immigration could not be stemmed. Soon, an increasing number of brash squatters began to settle on Vicente Peralta's property, pitching tents and erecting shacks, hunting game, planting crops and occasionally poaching Peralta cattle.

Although the pace was slower, a similar situation was taking place within Ignacio Peralta's portion of Rancho San Antonio. Contra Costa County was officially founded in 1851 (Purcell 1940), and Alameda County in 1853 (Wood 1883). Anglo-Americans were soon settling in the area where the city of San Leandro exists today.

In spite of the transfer of authority over California from Mexico to the United States, and the resultant increase in Anglo-American immigration to the East Bay region, the Peralta Brothers managed to keep their estates largely intact until the close of the 1850s. For example, on February 3, 1858, Ignacio Peralta's claim to his 9416 acre estate was validated by the American courts (Conmy 1961:5; Wood 1883:335).

However, the Anglo-American tide could not be stemmed indefinitely and, over the years, the Peralta family reluctantly sold off portions of their vast estates in the East Bay region. Litigation concerning the ownership of portions of Rancho San Antonio continued until 1885, but "long before that the great Rancho was gone -- broken up into farms and townships" (Fibel 1971:21). The following passage describes the end of the Peralta era as the most prominent family of the East Bay region:

> Rancho San Antonio went the way of the missions, into legend. The disillusioned Peraltas were eventually reduced to living on small lots, where finally reconciled, they tried to emulate the Americanos... Ignacio built a red brick house in 1860... in San Leandro.

> This is said to be the first brick house built in Alameda County and is now the Alta Mira Club House with a California Historical Landmark designation # 285 (Fox 1975:67).

Ignacio Peralta died in 1874, and after this date the dispersal of what remained of his estate accelerated. A detailed check of maps, oral accounts and other documentary sources for the second half of the nineteenth century, failed to uncover any specific historical documentation regarding the development of that part of the Peralta estate contained within the present Buckhorn Reservoir project area. However, as we have seen, archaeological surface reconnaissance encountered the foundations of an historic period structure and associated features, now identified by the designation CA-Ala-482H, that may possibly date from the last years of Peralta ownership of the Alameda County portion of the subject property. Based on observable surface characteristics, the structural remains in question were standing in the late 1870s or early `80s and may have been erected considerably earlier. It is possible that this structure was associated with the Peralta family's cattle grazing activities; alternatively, this structure may have provided shelter for one of the many squatters who had established themselves on the Rancho San Antonio during this period, or it may have been built by a subsequent owner or tenant. Unfortunately, there is at present insufficient historical or archaeological evidence to support any of these suppositions. What is certain, however, is that these archaeological remains represent the earliest tangible

remainder of historic period activity within the confines of the proposed Buckhorn Reservoir site (see Archeo-Tec 1987a; 1987b).

A detailed recitation of the often tangled web of changes in ownership of the various portions of Ignacio Peralta's former estates, as well as that of Joaquin Moraga, during the second half of the nineteenth century and early decades of the twentieth lies beyond the scope of the present report. Suffice it to state that throughout this period title to the various portions of the once unified Rancho San Antonio, including the present Buckhorn Reservoir Site, passed to other individuals. However, documentary research revealed that throughout this period, the present project area and its immediate surroundings remained virtually undeveloped, and use of the land was limited to cattle grazing and related activities.

The association between the project sponsor, the East Bay Municipal Utility District (EBMUD) and the present subject area and its surroundings can be traced as far back as the first quarter of the twentieth century. As early as 1923, EBMUD began acquiring lands in the upper San Leandro watershed area, including the present Buckhorn Reservoir site. Between 1923 and 1952, a EBMUD adopted a total of 78 resolutions regarding the acquisition of property in the Upper San Leandro watershed area (Data on file at the EBMUD library in Oakland, California).

Today, as we have seen, the Buckhorn Reservoir site remains in a relatively pristine condition, one of the few parts of the East Bay that is still largely unchanged from the days of the Peralta and Moraga families and their regional antecedents, the Costanoans.

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Historical Overview of the Proposed Pinole Reservoir Site
Contra Costa County, California

Submitted to:

EIP Associates
319 Eleventh Street
San Francisco, California 94103

Submitted by:

Archeo-Tec
114 Wilding Lane
Oakland, California 94618
25 August 1987

Site Location and Description

At the request of Mr. John Davis of EIP Associates in San Francisco, Allen G. Pastron, Ph.D, of Archeo-Tec has conducted an archival survey of the history of the proposed Pinole Reservoir site, located on Pinole Creek, approximately 1 mile southeast of the City of Pinole, in Contra Costa County, California. The principal goals of the present report are to provide a general overview of the history of the project site and to describe the uses to which the property has been put from prehistoric times through the twentieth century. To develop the Pinole Reservoir, the project sponsor, the East Bay Municipal Utility District (EBMUD), proposes to construct a dam and associated facilities and inundate an area of approximately 860 acres.

The subject property is primarily characterized by gently rolling grasslands, ranging between 200 and 340 feet in elevation. Dominant vegetation consists primarily of introduced grasses, with cluster thistle, introduced cardoon and milk thistle, poison oak, mustard and numerous wild flowers, including California poppy, genians and centuries. Horehound occurs locally, and chia is locally abundant. Small stands of California scrub oak are scattered sporadically throughout the project area, as are Blue Oak, Buckeye, Prunus sp., and Sitka Willow.

Pinole Creek courses in a westerly direction through the center of the project area. This, as well as a number of unnamed feeder tributaries are lined with dense riparian foliage, including the above noted trees as well as Pacific Willow, Bay laurel, Big Leaf Maple and Pacific Madrone; blackberry thickets and poison oak were noted within the riparian zone as were clusters of cattail, rushes, watercresses and mosses. In places, these thickets are so dense as to inhibit crossing the steep-sided ravines.

Dominant site geology consists primarily of soft, weathered sandstones which outcrops only rarely throughout the project area. Dominant soils throughout the project area are sandy clays which range in color according to depth, from rich brown top soil near the ground surface to yellow sandy clay beneath.

Present usage of the proposed Pinole Reservoir site is primarily devoted to cattle grazing. However, the eastern half of the project area, south of Pinole Creek Road, is presently used for the cultivation of oats, wild wheat and vetch.

Moderate alteration to the original landscape has occurred in the recent past. South of Pinole Valley Road, the eastern part of the subject property has been subjected to intensive tilling and cultivation during the past several decades. Several residential structures, as well as a barn and a stable, exist

within this portion of the subject property; there is also a network of graded dirt roads. Still within the eastern part of the subject property, the level of disturbance is less marked north of Pinole Valley Road: several stables and dirt roads represent the only modification of the original landscape within this part of the research area.

The northern area of the proposed Pinole Reservoir site contains five marshy ponds, only one of which is noted on the USGS topographic map, (Briones Valley 7.5'). Earthen levees in the vicinity of these ponds suggest considerable localized disturbance to topsoil. A single aluminum barn, two large water tanks and a windmill were noted within this part of the project site. Numerous dirt roads are scattered throughout the property. With the exception of the above noted earthen levees, disturbance is minimal within this portion of the project area.

With the exception of the areas south of Pinole Valley Road and east of Castro Ranch Road, the western part of the proposed Pinole Reservoir site is the most pristine portion of the subject property. Within this area, localized dumping of construction rubble, a residential structure, a graded dirt road and a Christmas tree farm have altered the original landscape to a degree.

<u>The Prehistoric Period (Ca. 6000 B.C. - 1770 A.D.)</u>

The first task of the present historical survey was to determine the potential for encountering archaeological resources from the prehistoric period within the confines of the subject parcel. When the Spanish first explored northern California in the latter part of the eighteenth century, the region possessed what has been described as "the densest Indian population anywhere north of Mexico" (Margolin 1978:1). It has been estimated that between 7,000 and 10,000 native Californians inhabited the naturally fruitful coastal area between Point Sur in Monterey County and the San Francisco Bay (Kroeber 1925:464).

Native American shellmounds -- massive heaps of ash, shell and cultural refuse -- once dotted the shoreline and adjacent inland areas of the San Francisco Bay. When N.C. Nelson conducted the first intensive archaeological of the region in 1908, he recorded no less than four hundred and twenty-five aboriginal shellmounds on or near the shoreline of the bay (Nelson 1909).

With this introduction to the prehistory of the San Francisco Bay area, we now turn to the evidence at hand for the proposed Pinole Reservoir site.

The project area is situated near the northeastern border of the territory which, at the beginning of the historic period, was occupied by the Costanoan Indians (see Key to Tribal Territories Map" in Heizer 1978: ix). The populous Costanoans inhabited a

bountiful natural environment and, as we have seen, left behind a prolific archaeological record. With this in mind, A.L. Kroeber noted the following:

> The entire Costanoan frontage on ocean and bay is lined with shell deposits. San Francisco Bay in particular is richer in such remains than any other part of the state, except perhaps the Santa Barbara Islands (1925:466).

Ethnographic and archaeological summaries of the Costanoans can be found in the following sources: The Handbook of North American Indians, volume 8 (see Levy 1978:485-495), the Handbook of California Indians (Kroeber 1925: 462-473, California Archaeology (Moratto 1984), The Archaeology of California (Chartkoff and Chartkoff 1984) and The Ohlone Way: Indian Life in the San Francisco - Monterey Bay Area (Margolin 1978).

Archival research revealed that no archaeological sites of either prehistoric or historic period age or character have been recorded within the confines of the proposed Pinole Reservoir project area.

Between May and July, 1987, the staff of Archeo-Tec, under the supervision of the present writer, conducted an intensive archaeological surface reconnaissance of the proposed Pinole Reservoir site. The results of this research are contained in two reports prepared by the present writer entitled A Literature Search and Archaeological Surface Reconnaissance of the Proposed High Pinole Reservoir, Contra Costa County, California, and A

<u>Supplementary Literature Search and Archaeological Surface Reconnaissance of the Proposed Pinole Reservoir, Contra Costa County, California</u> (Archeo-Tec 1987a; 1987b).

Archaeological surface reconnaissance of the proposed Pinole Reservoir project area encountered a prehistoric midden deposit of apparently substantial dimensions. Since its discovery and formal recording, this site has been given the designation of CA-CCo-549. On the basis of surface indications, CA-CCo-549 appears to represent an extensive and significant habitation site. Unfortunately, few other details concerning the areal extent or specific archaeological characteristics of this midden deposit are presently available.

In addition to CA-CCo-549, the Archeo-Tec survey team identified a cultural isolate -- in the form of a large shell fragment -- at a place where a local resident claimed to remember the presence of an archaeological site. This cultural isolate has now been officially designated CCo-Iso-12. The land in the immediate vicinity of CCo-Iso-12 was under cultivation at the time of Archeo-Tec's April, 1987 survey, and it was unfortunately impossible to determine at that time if other surface or subsurface cultural resources were associated with the isolated shell fragment that was encountered.

Information regarding the recently discovered prehistoric

cultural resources within the confines of the proposed Pinole Reservoir site is on file at the Northwest Information Center at Sonoma State University, and at the offices of Archeo-Tec.

The Historic Period (1770 - Present)

The East side of the San Francisco Bay was first explored by the Portola expedition in 1769-70; a few years later, in 1772, Pedro Fages made a more thorough survey of the region (Conmy 1961:3). Between the appearance of the first Spanish ship to sail through the Golden Gate (the San Carlos under the command of Lieutenant Juan Bautista de Ayala), and the discovery of gold at Sutter's Mill, the East Bay region remained almost entirely undeveloped and uninhabited by Europeans. During this period, population and maritime traffic were extremely limited throughout the San Francisco Bay area. The Presidio at San Francisco was officially founded on the site near the Golden Gate in September, 1776, in a place convenient for the emplacement of an artillery battery at the narrowest part of the harbor entrance. A month later, the Mission was founded at the Laguna de los Dolores (Olmsted, Olmsted and Pastron 1977:257). Throughout the remainder of the eighteenth century, the eastern shore of the bay was occupied solely by its Native American inhabitants.

The first white settler in the area of the present day city of Pinole was Ignacio Martinez, one of the most respected early

Spanish settlers in <u>Alta</u> California. Purcell describes Don Ignacio Martinez and his arrival in the Pinole Valley region:

> Commandante Don Ignacio Martinez, one of the most aristocratic of the Spanish dons of early California, was chief military officer of the presidio of San Francisco in 1823 when he received possession of Rancho El Pinole in Contra Costa. To fulfill the requirements upon which grants were made by the government he proceeded to build a home and other houses of adobe in the valley of Pinole, brought cattle and other property and made improvements of a similar kind (1940:142).

A description of this early historic period settlement of the Pinole Valley region is provided by a volume entitled <u>Illustrations of Contra Costa County</u>, first printed in 1879 by the Contra Costa Historical Society:

> During the year 1823 Francisco Castro made application to the Mexican authorities for the San Pablo Rancho, and Ignacio Martinez for the Pinole Rancho, to the extent of four leagues of land each. These men, who were the pioneer white settlers on our county, planted vineyards and pear orchards at their ranchos more than half a century ago. They made other little improvements; each of them built an adobe house and a few corrals. Their neighbors were the families of Peralta at San Antonio, and Castro at San Lorenzo, until about the year 1826, when Jose Maria settled upon the San Ramon Rancho (at Dublin), where he obtained a grant of four leagues of land (1952:11).

An examination of maps and other historic documents confirms that the present Pinole Reservoir site lies within the boundaries of Ignacio Martinez' Rancho Pinole. The volume <u>Illustrations of Contra Costa County</u> provides a fascinating glimpse into the patterns of everyday life on Rancho Pinole and adjacent settlements:

> The ranch owners usually had employed a few vaqueros to herd and take care of their stock. The vaqueros were generally Mission or Christianized Indians... Although deprived of society and comparatively alone, the people

> were generally contented and apparently happy. The ranch owners were very hospitable at their homes... Very little attention was given to agricultural pursuits... [other] than that nearly every ranch owner had cultivated a few acres of beans and corn, and a small potato patch, with a few other vegetables, and a few rods square planted in melons. This was about the extent of farming carried on at the different ranches. Almost all of the rancheros, when locating their ranches, planted small vineyards, and many of them a few pear trees. Many of these vineyards and trees bear fruit to this day (ibid).

Ignacio Martinez' adobe was located well to the west of the Pinole Reservoir site, near the present day city of Pinole. Apparently, none of Contra Costa County's early historic period adobes were situated within the confines of the proposed Pinole Reservoir site (Hendry and Bowman 1940): similarly, archival research produced no evidence that any of the major economic or social activities that occurred at Rancho Pinole were conducted within the confines of the present project area. As far as can be determined from documentary research, the greater part of Rancho Pinole, including the entirety of the present research area remained in an essentially pristine state throughout the ownership of the property by the Martinez family. This finding is really not surprising considering the relatively scarce and scattered population in Contra Costa County throughout the period of Spanish/Mexican hegemony over the region. Jacob Bowman notes that a total number of 57 adobes were built in what today is Contra Costa County, with an additional 115 structures erected in adjoining Alameda County (1851:59).

With the discovery of gold in the Sierra Nevada foothills

in 1849, an ever increasing number of Anglo-Americans found their way to the eastern shore of the San Francisco Bay and settled in what today is Contra Costa County. The County was formally founded in 1851. In spite of the transfer of authority over California from Mexico to the United States, and the resultant increase in Anglo-American immigration to Contra Costa County, the Martinez Brothers managed to keep their estates largely intact until the close of the 1850s. The Martinez land grant of 17,786.49 acres was validated by American courts on October 24, 1854 (Purcell 1940:143).

By the mid-1860s, Contra Costa County was changing, and Purcell describes the acquisition of Rancho Pinole by the Tormey family:

> In 1865, John and Patrick Tormey acquired large portions of Rancho El Pinole. Jointly they bought 7,000 acres, which embraced all the land facing San Pablo bay from the town of Pinole to and including the Western half, which took in Pinole itself, the original adobe hacienda of the Martinez family in Pinole valley and many additional acres in Pinole and Briones valleys now owned by the Fernandez estate, EBMUD, Atlas Powder Company, Cole estate and others. John Tormey built a very fine home in one of the prominent sections of his domain. The house is now a landmark owned by the East Bay Municipal District (1940:143).

Another documentary source also notes the transfer of ownership of the major part of Rancho Pinole in the mid-1860s from the Martinez' to the Tormey family:

> Mrs. John Tormey owns about 3,000 acres of the Pinole ranch, originally four leagues of land granted to Ignacio Martinez. The residence is situated in a romantic valley, through which passes Pinole Creek. It is about eight miles from Martinez and the same from

> Pinole Station (Contra Costa Historical Society 1952:35).

In addition to the Tormeys', who purchased a large portion of the former Martinez property, other people were acquiring less extensive parcels of land in the area and establishing small farms during the second half of the nineteenth century. One such individual was Joseph Pfister, who had previously operated a colorful adobe lodging house in the town of Benicia during the late 1840s and `50s:

> In 1866 Jos. Pfister bought his present home of 160 acres, where he can raise a crop whether the season be wet or dry. The farm is fenced off into four sections, the residence is a two-story frame building, surrounded by a beautiful garden and orchard. A large and commodious barn is situated about 150 feet from the dwelling, and is capable of holding about 30 tons of hay. Water is supplied by an artesian well. The farm is about one mile from Pinole station and the wharf, thus affording two very convenient facilities for shipping farm productions (Contra Costa Historical Society 1952:34).

It should be noted that there is no evidence to suggest that Mr. Joseph Pfister's property was located within the confines of the proposed Pinole Reservoir site; however, since his activities seem to typify the general demographic trends occurring in this part of Contra Costa County during the second half of the nineteenth century, they are included here.

In the 1870s, large segments of the former Martinez Rancho was acquired by the Fernandez family. Believing that the area possessed great potential for growth and prosperity, Mr. Fernandez made his home near the present day city of Pinole in antici-

pation of the region's future growth; this aspect of local history is described by the Contra Costa Historical Society:

> B. Fernandez owns the most valuable portion of this little village at the mouth of the rich and beautiful Pinole Valley, which has, by the construction of the railroad, come into very important notice. Its nearness to the metropolis, and fine situation for a village, must, in the near future, make the place much sought after for suburban residences. There are many desirable building sites in this neighborhood, which are certain to be occupied, and a large village will grow up here as soon as its advantages become known (Contra Costa Historical Society 1952:34).

In addition to his interests near the present day city of Pinole, Mr. Fernandez also acquired a substantial tract of property in the vicinity of the proposed Pinole Reservoir site.

Throughout the second half of the nineteenth century, alterations to the natural landscape in the vicinity of the proposed Pinole Reservoir site remained minimal. The area was almost exclusively devoted to cattle grazing and, apparently, a limited amount of agriculture. Only a few scattered structures had been erected throughout the area.

Other than the general overview presented above, a detailed recitation of the lengthy list of changes in ownership of the various portions of Ignacio Martinez' former estate during the second half of the nineteenth century and early decades of the twentieth lies beyond the scope of the present report. Suffice it to state that throughout this period title to the various portions of the once unified Rancho Pinole, including the

present Pinole Reservoir Site, passed to other individuals.

The association of the East Bay Municipal Utility district with the subject property formally began on August 7, 1946, when the Chief Engineer of EBMUD authorized a plan for the acquisition of lands for the proposed Pinole Reservoir. Two resolutions were subsequently enacted, one dated December 14, 1956, the other dated December 20, 1957. Both of these resolutions referred to the actual purchase of land for the proposed reservoir.

Today, as we have seen, the proposed Pinole Reservoir site remains in a relatively natural state, one of the few parts of the East Bay that still resembles that natural topography familiar to Ignacio Martinez and the original inhabitants of the region, the Costanoans.

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